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ABSTRACT

Sound play is important to child language development in that it contributes to the phonetic substrate, it is a factor in phonological development, and it is something to be learned as part of the socially acceptable use of language. Sound play progresses in three stages: (1) babbling, in which a gradual acquisition of phonetic units is built up and then narrowed down to approximate adult speech sounds; (2) expressive sound play, where the primary focus is the sounds rather than the meaning, and includes exploratory behavior, sound practice, and "pure" sound play; and (3) language games, in which sound play becomes more elaborate and where conscious, explicit, and socially prescribed rules for sound play are developed. A cognitive model views the child as an active rather than a passive language learner. This active role is evidenced in the child's selectiveness in exploration of input, his creativity in production of segments and patterns not in the adult phonology, and his formation, testing, and revision of hypotheses about the phonological structure of the language. (PJM)

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PHONOLOGICAL DEVELOPMENT IN CHILDREN: PLAY AND COGNITION

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Phonological development as an arena for psycholinguistic research offers the same kinds of theoretical issues as other aspects of the development of language and communication, such as its relation to cognitive development and the developmental role of play. Most research on child phonology, however, because of its special origins, has investigated other issues, such as the nature of children's sound substitutions and the existence of a universal order of acquisition. In this paper we attempt to redress this imbalance. We fully recognize the unique characteristics of phonology, and even see research advantages in them, but the issues we explore are general developmental questions that usually appear as marginal in the literature on phonological development.

Before moving on to the principal issues of the paper we must insist on the essential role of phonology in language development. It is tempting to say that children are basically learning to 'mean', i.e. to interact and communicate in the ways of humans (specifically those of the surrounding speech community), rather than learning to use speech sounds and to pronounce their native language. A moment's reflection reminds us, however, that the central fact of language development is the pairing of sounds and meanings, and that 'learning to mean' is simultaneously 'learning to sound'. Even in the special case of learning a manual signing system as one's first language, the pairing of sign and meaning is central, and phonological development has its analog in the acquisition of the configurations and movements of the hands and other parts of the body. Phonological factors are involved in language development fromits earliest beginnings and continue to be operative throughout. No model of language development which fails to account for phonological development can be regarded as adequate.

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Our hope is that this general paper on phonological development will make developmentalists more aware of phonology as an important aspect of development and that it will open up to child phonologists a range of significant issues not often treated by them. In some instances the material offered may even be of direct assistance to non-phonologists by providing novel conceptualizations and unfamiliar developmental data which can contribute to their work. As child phonologists ourselves, we find that the writing of the paper has broadened our own perspectives on phonology, and we hope its contents will affect other phonologists as well.

Two sections follow. In the first, we discuss the role of sound play in phonological development with a focus on three general types: babbling (the fourth to tenth months of life); expressive sound play (roughly ages two to five); and language games (early adolescence). In the second section, we briefly examine the changes in research of the past decade that reflect a shift from universalist-linguistic models to a broadly cognitive model of phonological acquisition. We then present an outline of such a model and the data on which it is based and conclude with an evaluation of the model's limitations. Both sections cover several basic issues which can be viewed afresh from the viewpoint of phonology or, on the other hand, can be newly examined for application to recognized questions in phonological development. The data are drawn in many instances from the research of the Stanford Child

Phonology Project (CPP) during the period 1970-80.[a]

1.0 PLAY

That children play with vocal sounds, including speech sounds, and that they play with language in terms of sound similarities and differences are truisms. Several different kinds of phenomena are included in what may be called "sound play" and there are problems in providing an adequate definition of "play" in general, but it is clear even without careful study that sound play is a very frequent childhood behavior. Further, it seems that language play, and more particularly sound play, is of considerable importance to language development in at least three different ways: as contributing to the phonetic substrate, as a factor in phonological development, and as something to be learned as part of the socially accepted use of language. These three aspects of sound play will be discussed here primarily in connection with (1) babbling, i.e. early vocal play contributing to the mastery of the phonetic substrate, (2) expressive sound play, i.e. the sound-based word play common during the development of phonological organization, ages 2-5, and (3) language games, i.e. socially specified, sound-based ways of altering language, used especially in early adolescence and among special groups.

The role of play in human life has been discussed at least as far back as Heraclitus in Western philosophical and scientific traditions, and it figures in ancient Hindu traditions and doubtless elsewhere in early times. The great burst of modern intellectual concern about play as a fundamental human phenomenon, however, is often traced to the Dutch historian Huizinga, whose 1938 book Homo ludens (English translation 1949) seems to have set off a train of major responses which contribute to the recent development of play-centered models, play theory, and game theory in sociology, psychology, anthropology, economics, mathematics, psychiatry, literary analysis, philosophy, and even theology.[1] Recognition of the importance of play in child development, however, preceded Huizinga's lectures and book. For example, two investigators who theorized about play in development in the first decades of the twentieth century were the Swiss psychologist Clarapède and Sigmund Freud. The former (e.g. Clarapède 1906) held that play is necessary in childhood as a kind of practice at becoming an adult. The latter (e.g. Freud 1908) held that play is the way the child gets pleasure out of unreality when faced

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[a]Since 1967, the Department of Linguistics at Stanford University has conducted a series of research studies under the cover label Child Phonology Project. These studies which have mostly focused on the acquisition of consonants in English, Spanish and Cantonese, have been supported by grants from the National Science Foundation, the National Institute of Child Health and Human Development and the William T. Grant Foundation.

[1]For the study of language play and child development the two most important lines of research and theory building have been the psychological and the anthropological. Among the many studies in these fields we found three books the most stimulating: Herron & Sutton-Smith 1971, Bruner et al. 1976, and Schwartzmann, 1978.

with the reality of adults controlling his world. Neither was interested in language development as such, and both would probably have been puzzled or bored by the question of how children acquire the phonology and syntax of their mother tongue.

Similarly, Piaget, when he discussed play in relation to sensorimotor and cognitive development in his book La Formation du Symbole chez L'Enfant (1946; translated into English as Play, Dreams, and Imitation in Childhood 1951), was only marginally interested in the acquisition of linguistic structure as a part of child development. His three categories (and various corresponding stages) of practice play, symbolic play, and social play are valuable concepts in child development, but he did not relate them directly to language development. More recently, as developmental theorists have focused more on play, they have extended and modified the Piagetian perspective and now include more direct attention to language (cf. e.g. Herron & Smith 1971, Bruner et al. 1976, Garvey 1977b). Most of this work is still concerned however, with cognitive development and the acquisition of communicative skills, and very little attention is paid to the development of phonology as such in spite of the phonological basis of much language play. Bruner's argument, in agreement with a number of other writers, is that play "draws attention to communication itself" and facilitates the development of segmentation and substitution, joint (caretaker-child) routines, and sequencing rules (Bruner 1975). His illustrations are at the level of word-in-sentence or component-in-speech-act, but the argument could be applied just as well at the level of sound-in-word.[2]

A few studies of sound play itself have appeared in recent years in connection with research on language development. Increased sophistication in techniques of recording and instrumental analysis of speech has made it possible to study babbling more systematically than could be done before. For example, Cruttenden 1970 reported on the babbling of a pair of twins, utilizing tape recordings and making comparison with the phonology of their early speech; Pierce 1974 reported on 750 children recorded during the first year of life; Oller and his associates analyzed the babbling of one child studied intensively and fifteen or more other infants (e.g. Oller et al. 1975); and Stark has done cross-sectional studies of many infants and detailed longitudinal studies of two infant girls (e.g. Stark 1975). All these studies attempt to categorize the vocalizations of the babbling infant and compare the categories with those of early speech. Although they occasionally use such expressions as 'vocal play' they make no attempt to define play behavior as such or to specify its relation to language development.

A number of observational studies of child language development, including traditional diary studies as well as highly focused discourse analyses and experimental investigations, have commented on the sound play in children aged 2 to 5 years and provide us with concrete examples of this behavior. The two most frequently cited studies are those of Weir 1962 and Keenan 1974. The

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[2] In the article cited, Bruner mentions phonological phenomena in connection with "puzzling" prosodic place-holders (10) and, more incidentally, in an illustration involving boo and achoo in parallel episodes (16).

former reported on the extensive vocal play of her son Anthony (2;10) in his pre-sleep monologs; the latter recorded the joint sound play of her twins (2;10) in early morning interactions when they were by themselves. Garvey's more recent study of dyadic interactions among nursery school children (2;10-5;7) also includes explicit discussion of sound play (Garvey 1977a). Although some attention is paid in these studies to the role of 'practice play' in language development, the authors are generally more concerned with the child's ability to play as part of his/her communicative competence and with sound play as a major category of child discourse: "...different aspects of language and language use become available for play as they are acquired, and...a closer look at play may help to reveal what has been learned..." (Garvey 1977a:47); "The systematic nature of [joint] sound-play discourse brings out the degree to which young children attend to the formal features of one another's utterances." (Keenan 1974:183).

Recent studies in the paradigm of ethnography of communication that focus on language play deal more explicitly with phonology (Sanches & Kirshenblatt-Gimblett 1976; Sherzer 1976), but not with phonological development. Sanches & Kirshenblatt-Gimblett in their article on children's traditional speech play simply assert that "for a young child -- and progressively less so for older children -- the phonological component of language is much more strongly organized than the syntactic, semantic, or sociolinguistic" (1976:77). In their view the traditional child rhymes most popular at 5-7 years are evidence for the child's control of phonology and if they facilitate language development it is not in phonology but in the acquisition of adult verbal art and poetic discourse. Sherzer's article on the more elaborate play languages or "secret languages" characteristic of young adolescents in many societies examines these phenomena in terms of their social functions and linguistic significance, not in relation to development. These studies are of interest to us here because of the evidence they offer of children's ability to operate relatively abstract and complex phonological rules, different from those of normal speech, in the creation of new, meaningful utterances, and also because they show that children acquire and use the socially accepted phonological games of their community as part of the total cultural inventory which is transmitted and adapted from generation to generation.

1.1 Issues

In any discussion of the role of play in language development we must first face the definitional question of what constitutes play behavior. We assume that the definitional question is substantive, i.e. that play is in some sense a 'natural' category (or set of related categories) of human behavior and we are not simply exploring the semantic value of such words as play, jeu, Speil, igra in a handful of European languages or ethnocentrically imposing our own work: play dichotomy. Many well-reasoned definitions are offered in the current literature. For example, Sutton-Smith favors the characterization of play as "an exercise of voluntary control systems with disequilibrial outcomes," (Herron & Sutton-Smith 1971:344) a descriptive definition which is based on extensive study of the whole field of play and games and distills much wisdom into a few words. Such definitions are, however, not very helpful at our level of wanting to decide what constitutes language play with sounds as opposed to other behaviour. We adopt here the strategem of listing a number of criterial characteristics on which most observers would agree: play is pleasurable activity,

it is voluntary and it has no apparent extrinsic purpose; it involves repetition and variation, it includes patterns of behavior which also occur in non-play activities, and it has markers to signal that play is going on. (For a similar list cf. Garvey 1977b:4-5; on the importance of repetition and variation cf. Sutton-Smith 1980; on play signals, cf. Aldis 1975, Ch. 9.)

The basic issues on the role of play in phonological development are the same as those in other aspects of child development. How and to what extent does play consolidate or improve the control of the child's (phonological) behavior at a given stage? How and to what extent does play serve as preparation for or practice in more advanced non-play (phonological) behavior? To what extent does the emergence of a type of play indicate a new (phonological) capability on the part of the child? What is the relation between individual and social aspects of play, and between biologically given and culturally prescribed play? Is (sound) play a necessary or a sufficient condition for normal (phonological) development?

After this cursory review of the literature and basic issues of the language play of children, let us turn to direct consideration of sound play phenomena as reported by observers of children's language behavior.

1.2 Babbling

The first type of play to consider is babbling, which in our opinion is a major factor in the development of the phonetic substrate required for phonological organization. The babbling of infants typically begins about the fourth month, reaches a peak between the sixth and tenth months, continues past the appearance of the 'first words' toward the end of the first year or shortly thereafter, and is still engaged in during most of the second year. Observers have noted the very varied, seemingly random kinds of vocalization that take place, without obvious referential meaning, and they often refer to babbling as vocal play, comparable to other motoric play of infants. In general, most babbling meets the criteria customarily set for play: it gives the appearance of voluntary, pleasurable activity with no utilitarian purposes, it has behavioral similarities to the non-playful speech which later replaces it as the predominant vocal behavior of the child, and it is marked as fun by smiles and laughter from the child and the mother or other communication partner. There is general agreement from Piaget on, that the vocal play of babbling contributes in important ways to the development of the sensorimotor skills involved in the perception and production of speech sounds. Fry 1966 states this clearly: "During the babbling stage, therefore, the child is doing two important things: he is trying out mechanisms that will be needed for speech, combining phonation with articulation and no doubt gaining a certain control of the respiratory system, and he is establishing the circuits by which motor activity and auditory impressions are firmly linked together." (Fry 1966:190)

On the relation between babbling and the phonological organization of 'true speech', however, there is less agreement. Two older views still persist in the literature although both of them have been shown to be wrong in important respects: the gradual approximation, 'behaviorist' view of Mowrer and others and the discontinuous, 'linguistic' view associated with the name of Jakobson (cf. Ferguson & Garnica 1975). Recent expressions of these views phrase them as follows:

> "The babbling of infants in all cultures initially shows a random distribution of phonemes but gradually comes to approximate those of the surrounding culture." (Aldis 1979: 252)
>
> "... there is ... a sharp discontinuity at both ends of the babbling period." ... "Children quickly pass from a wealth of vocalization to concentration on a few sounds for conversation." (McNeil 1970:130-131)

Recent research on babbling (e.g. Cruttenden 1970; Oller et al. 1975, Oller 1980; Stark et al. 1975, 1978, 1980; Zlatin, Laufer & Horii 1975) has established beyond doubt that there is a gradual development in the phonetic structure of vocalizations during the babbling period. Different types of vocalization tend to emerge or to predominate at different stages in the development of babbling. The appearance of certain types is so regular that they may be considered 'landmark' types useful for the measurement of language development. The most notable of these are the early emergence of back sounds combining voicing and friction noise, commonly referred to as 'cooing', and the emergence of strings of identical CV syllables (e.g. dadada...), referred to as 'canonical babbling'. The research has further shown that there are systematic relationships between the phonetic characteristics of a child's babbling and those of this early speech. These include the development of 'speechiness' in babbling parallel to development in permitted phonetic complexity in speech, similarities in the order of acquisition and relative frequency of particular sound types, the progression in vowel qualities which seems to cut across babbling and speech, and the appearance (or increased frequency) of sound types in a child's babbling which are about to appear or have just appeared in his/her speech.

By the development of speechiness in babbling is meant the movement from internally undifferentiated sound complexes toward increased clarity of segmentation (sequences of consonant-like and vowel-like sounds). The most comprehensive phonetic classification of babbling behavior is that of Oller 1980, which lists twelve vocalization types, from QRNs ("quasi resonant nuclei") to GIBs ("gibberish"). Oller is able to identify corresponding characteristics of adult human speech for most of his vocalization types. The appearance of the successive additional characteristics constitutes a developmental line proceeding from a non-segmental vocalization hardly like adult speech at all to sequences of recognizable syllabic structure and internal phonetic variety quite comparable with adult speech. The significance of play in this development is shown first by the onset of cooing, which is the first appearance of apparently voluntary, pleasurable vocalization, as opposed to crying or other 'distress' vocalizations and so-called 'vegetative' ones. The role of play is even more evident later on as the child is apparently "constantly trying out new combinations and recombinations of sound making skills" (Stark 1980:000) in his/her vocal play.

A striking parallel to this development in speechiness appears in the gradual increase in the range of syllabic structures and phonetic variety of segments within the same syllable or word which occurs in phonological development at a later stage. This later development in "permitted complexity" has been analyzed at the Stanford CCP and elsewhere. Although children seem to vary greatly in the orderliness of this development, it is likely to be a universal phenomenon; for general discussion and the detailed analysis of

one child (followed by the CPP) cf. Macken 1978b. The gradual increase in permitted complexity of segmental phonetic structure is thus another example of Piaget's decalage or Bruner's spiraling, or Sutton-Smith's genetic recursiveness. The child follows a similar path of development first at a simple, more basic level, and then again later at a more complex, hierarchial level of behavior.

The progression in speechiness is of interest also in that it manifests the primacy of prosodic features over segmental ones in phonological development. Although a number of investigators have claimed the very early acquisition of sentence prosodies, especially intonation contours, in comparison with the acquisition of the segmental material (e.g. Bever et al. 1963), this issue remains controversial because of the methodological difficulties in the collection and analysis of the data (Menyuk & Bernholtz 1969; Bloom 1973:18-19, 41-45, 59-64; Crystal 1973, 1978; Scollon 1976:74-87).[3] The last several years, however, have seen a succession of studies of the acquisition of word prosodies, especially lexical tone, pointing to early acquisiton. Most of these studies are based on varieties of Chinese and the total number of subjects studied is fairly small, but the evidence indicates early phonetic accuracy, early mastery of sandhi rules, and relatively few errors at any stage as compared, for example, to the acquisition of consonant systems (Li & Thompson 1977, Tse 1978, Clumeck 1977, Jeng 1979; the pioneer study is Chao 1951; for a review of the field cf. Clumeck 1980). The speechiness development and early acquisition of prosodic aspects of speech are doubtless related to the importance of the word as a total phonetic unit at the early stages of speech (cf. Ferguson & Farwell 1975, Macken 1979b). It may even be worth speculating that the ontogenetic primacy of prosodic phenomena may reflect a phylogenetic primacy. Certainly one of the unique characteristics of human speech is the use of a small inventory of commutable segments as opposed to the non-segmentable vocal signals of other animals.[4]

Phonological development in early speech is characterized by certain universal patterns of acquisition. Certain sounds tend to be acquired before others no matter what the language being learned. For example, stops tend to be acquired before fricatives (e.g. p t k b d g before f s sh v z), labial consonants before alveolars (e.g. b m before d n), non-glottalized before glottalized (no English examples), low vowels before high (e.g. a before i u), semivowels before liquids (e.g. y w before l r). The apparently random vocal play of the infant, when examined carefully, is found to exhibit these same patterns. The child plays more with stops than fricatives, more with low

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[3] Our view of the present evidence is that children typically acquire some intonation contours of the adult language during the babbling period, but that children vary greatly in the extent to which they attach to the contours distinctive semantic values matching adult ones. Differences in opinion among investigators reflect this individual variation in children as well as different theoretical assumptions and research methods.

[4] This view is not meant to suggest that word prosody phenomena in a given language are older or more primitive in the phonological system of the language, since in many cases it is clear that the tonal system has arisen secondarily as a result of diachronic change in the phonology of a language.

vowels than high, etc. The patterns appear both in the relative frequencies of occurrence overall in babbling and in the order in which they tend to emerge and predominate during the babbling period. Cruttenden 1970 and Oller 1974 address this point directly. This patterning goes counter to the predictions of both the approximations model and the discontinuity model. In opposition to the former, the developmental pattern is repeated at another stage in the phonology, and in opposition to the latter, the underlying principles assumed for phonological organization are prefigured in the babbling period. The same physiological constraints (articulatory and auditory) affect the vocal play and the development of phonological organization in speech, although the cognitive level of the latter is higher (see 2. below).

The development in vowel production, as reported by recent researchers, shows a phonetic continuity in two respects; the increasing total range of vowel qualities and the increasing separation of different vowel qualities (i.e. reduction in borderline productions and overlapping productions of apparently different vowels). This point was made earlier in studies by Irwin and his collegues, but without the sophistication of separation of babbling and speech, indentification of non-English sounds, and use of advanced techniques of acoustic phonetic analysis. For recent accounts cf. Gilbert 1979, Lieberman 1980.

Probably the most striking connection between babbling and speech is the phenomenon of increased vocal play with a particular sound at about the same time that the sound first appears in the phonological repertoire of speech. This phenomenon, which by its very nature occurs only during an overlap period when a child is producing both babbling and speech, is well attested for a few children. The best account in the recent literature is the acquisition of /d/ described in Labov & Labov 1978:837-839. Their child J, a "relatively late talker," produced both babbling and words during her 17th to 20th months. Her principle words were cat and mama, but she experimented with a half dozen other words during the period, one of which was dada. She had babbled sequences including a [d] sound as early as 9;15 but showed no ability to use it in words until toward the end of the 16th month. At that time there was a great deal of babbling with [dæ] syllables culminating after a few days in daddy, which reappeared a month later in a stable form [dædæ]. The details of the fluctuation in both babbling and speech give a fairly complicated picture, with several peaks of different kinds, but the Labovs' conclusion is unequivocal: "phonetic experiments with dada originated in babbling and the impulse given by vocal play" (838). On the basis of this kind of evidence, as well as other evidence from semantics and syntax, the Labovs state as a characterization of language development: "Learning language is a game played with great intensity and energy....[the child] is learning how to control the linguistic mechanism, so that it will eventually go where she wants it to go, and say what she wants it to say" (851). This characterization is not defended in detail, however, nor explicated by careful definition of the terms.

Of greater interest in the Labovs' article is their view that the primary function of vocal play and experimentation during late babbling is not mastery of sensorimotor skills or the prefiguring of the sound types of early speech, but the acquisition of certain "generalized abilities" or "operating principles" which are needed for phonological development. The Labovs list

the most prominent of such principles as maximal dispersion, arbitrariness of the sign, unnaturalness of canonical forms, and the asymmetry of speaker and hearer in pronunciation. This view of vocal play is reminiscent of Bateson's "deutero-learning" and play theorists such as Vygotsky and Sutton-Smith. By means of play the child is "learning to learn" rather than simply preparing for or practicing specific skills. This view is attractive, and the data from J are highly supportive of it. During the five-month period that the Labovs describe, J repeatedly shifted the focus of her play and acquired very few stable words. At the end of the period she began to lose both her vocabulary and her phonological system, and in about a month and a half they were almost all gone. When she re-started her lexical and phonological development in her 21st month she apparently brought with her these generalized abilities rather than specific sounds and words, and the new phonology developed along different lines. Unfortunately for the generalizability of the Labovs' view, J's development does not seem to be typical of the transition from babbling to speech, and detailed descriptive studies of other children are needed. Nevertheless, even if J's development is highly idiosyncratic in some respects, this "deutero-learning" function of babbling is a possibility which must be investigated in other children's behavior.

The transitional phenomena at the overlap of late babbling and early speech constitute a critical locus for understanding phonological development and in particular the role of vocal play in such development. As is apparent from the literature cited here, the most sophisticated studies of babbling have stopped short of early speech, and the phonological studies of early speech do not reach down to babbling. The CPP is just initiating a research study "Phonological precursors to early speech" which will attempt to analyse these transitional phenomena.

1.3 Expressive sound play

The second type of sound play to be considered is the language play in which a solitary child or interacting children produce successive utterances where the primary focus is on the sounds rather than the meanings. Such sequences may involve juxtaposition of real words or phonetic modifications of them or may consist in whole or in part of nonsense material. Typically the fact that sound play is taking place is signalled by laughter and other devices. On this last point we may quote Keenan's comments on expressive sound play between her twins: "First, paralinguistic cues indicate that the children themselves realize they are using language in some manner out of the ordinary. Sound play is often engaged in on a relatively high pitch level. Further it is generally accompanied by laughter. An utterance is produced. A burst of laughter follows. The utterance is repeated or modified by the co-present interlocutor, and so on" (Keenan 1974:171).

The speech of children between 2 and 5 is full of this kind of sound play, and variants of it continue for the next several years, yet there is very little systematic study of the phenomenon. Perhaps developmental psycholinguists are so much impressed with the seriousness of playing their own professional game that they tend to exclude this kind of silliness from the purview of their research. Be that as it may, so pervasive a phenomenon during this important period of language development deserves more attention. The behavior has been so poorly described that it is difficult to subcategorize it,

but at least three kinds of behavior seem to be involved (not excluding some indeterminacy or overlapping between them). The first, and least well documented, is exploratory behavior, in which the child seems to be seeing whether a particular sound or sequence of sounds is sayable. The second is sound practice, in which the child seems to be deliberately drilling on phonetic or phonological characteristics of the language being acquired. The third is what we might call "pure" sound play in which improvement in the mastery of the sound system -- if it is taking place at all -- is not obvious: the child is enjoying the sound play for its own sake.

Exploratory activities are sharply differentiated from play activities by many theorists (e.g. Aldis 1977:67-75). Object exploration, for example, is a "serious" activity in which the novel object is approached cautiously and the main goal seems to be to acquire information about the object -- its physical properties and possible uses -- through receptor contact. Object play, on the other hand, is non-serious activity in which the object is approached in a direct, relaxed way and the main goal seems to be effector activity. Also, the incidence of exploratory and playful activities in different species varies independently. Yet, exploration may precede play in a natural sequence of behaviours (as in the approach to a new toy), and the boundary is not always easy to draw (cf. Millar 1968 Ch. 4; Garvey 1977b:46-51). Studies which distinguish between the effects of exploration and play and suggest that prior play correlates with level of creativity and problem-solving ability (e.g. Sylva et al. 1976) do not usually deal with language play. Hutt (1966), in her careful distinctions between kinds of exploration and play, explicitly excludes human play which has linguistic content.

It is likely that some babbling behavior belongs in the category of exploration and manipulation rather than pure play, but observers have not tried to distinguish between them. Garvey's brief discussion of babbling (1977a:30) seems to suggest that all babbling is exploratory and that the "verbal play with sound" begins with the first words. This area needs more focused research. Is there a vocal analogue to object exploration and play? Does the child, for example, sometimes react to a novel sound from his/her mother or the environment with serious exploratory imitations of it and then shift into playful repetitions with variation?

Weir indentifies what she calls "sound practice" as distinguished from "sound play" (Weir 1970:108-109). Sound practice, "a conscious exercise of learning a new phonemic contrast," is not common in her corpus. Weir reports that it occurs with two phonemes Anthony is still having trouble with, /θ/ and /æ/. The example she discusses is practice in differentiating /ɛ/ and /æ/. Anthony had been given some raspberries at a neighbor's house and had enjoyed eating them. At one point in his evening monologue he seems to be referring to this episode and ends up practicing the contrast between /ɛ/ and /æ/ in the word berries. In the transcript of this episode here the two pronunciations are spelled in ordinary orthography; for full phonetic transcription cf. Weir 189-190.[5]

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[5]This sequence includes a number of other instance of Anthony's /æ/, /ɛ/, and [a], and this is probably related to the practice on berries. His /æ/ appears in thank, back, his /ɛ/ in that's, and his /a/ in Alice; these pronunciations of the respective words were stable at the time and show the last stages of perfecting the pronunciation and lexical incidence of /æ/.

thank you (5 x)	wicked Alice	berries
thank you for the berry	good	not barries
go back Mommy	that's good	barries (2 x)
back for the berries	berries	not barries
all gone (2 x)	lookin' berries	berries
for the berries	back please	ba (2 x)
ah		

Intentional practicing of a sound is better documented for a somewhat younger child, Brenda, whose linguistic development is described in Scollon 1976. Brenda did a great deal of repeating when she was still at the one-word sentence stage, age 1;0 - 1;7, and Scollon discusses the function of repetition at this stage.[6] Some of the repetitions are successive approximations in the sense that Brenda seems to be trying to achieve a better pronunciation of a word for her own satisfaction. For example, at 1;7.2 she says in succession s, šI, š, šIš, su, su?, sus, ši, šI, šu for shoe. Such sequence Scollon calls "phonological repetitions." Others are repetitions of a word in various pronunciations until it is understood and gets a response. For example, at age 1;0.2 the following exchange takes place:

Brenda	Mother
fẽĭ	
fæ̃	Hm?
fæ̃	Bathroom?
fanĭ	Fan! Yeah.
fãi	
k^hu	Cool, yeah. Fan makes you cool.

Such sequences Scollon calls "discursive repetitions." The difference between the two types, however, is not always clearcut. For a period of several months, over half of Brenda's uses of words involved repetition, usually once or twice, but sometimes as many as ten or more times. Scollon concludes: "Probably the most plausible explanation of this high number of repetitions is that Brenda is using them to learn phonology" (79). Apparently he means that she is both trying to get the pronunciation just right (as she intends it to be) and also testing the range of acceptable phonetic variation. He sees imitation and repetition as two phases of the same learning process. "Imitation provides the means for the child to practice contrasts that are not yet within her own productive phonological system. Repetition provides the means for elaborating

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[6] Scollon notes that most observers edit out the repetitions of the same word along with unintelligible stretches and imitation. One of the merits of the Scollon study is the detailed analysis of the imitations and repetitions in his data.

that system from within and testing it against the model system." He also points out that the amount of prior repetition or "rehersal" seems to be a factor that affects the phonetic shape of utterances (221).

Another case of sound practice is documented in Weeks' study of Leslie, a bright and highly verbal child whose phonology developed very slowly. During the period 2;10 to 3;0 she repeatedly picked "target words" which gave her difficulty and drilled herself on particular segments (Weeks 1974:57-62).

If we wish to include sound practice in our notion of play, the data and interpretations of Weir, Scollon, and Weeks help us to see it as contributing to phonological development. Weir, however, seems to find sound practice a more serious, extrinsically motivated behavior which may be embedded in playful use of language but is not itself play. Scollon does not attempt to classify Brenda's verbal behavior into play and non-play,[7] and Weeks does not regard the practice as play.

The category of sound play most often found in the literature is neither exploration nor practice but "pure" sound play, in which the pleasurableness for the child and the apparent lack of developmental function are noted. In Weir's account, which is one of the fullest (it includes 65 pages of Anthony's monologues), the primary function of sound play is said to be the poetic function in the Jakobson sense, i.e. the poetic exploitation of the resources of language. Thus the child's sound play is held to be an early manifestation of the function of language which appears in adults in a variety of uses ranging from puns, word play, and advertising slogans to pure poetry. Anthony's numerous instances of assonance, alliteration, rhyme, and repetition are persuasive evidence for this view, just as his numerous paradigmatic drills are persuasive evidence of the metalinguistic function of language. In addition, however, the sound play may very well contribute to phonological development. In connection with grammar Weir comments: "The child finds great joy in practicing his discovery that linguistic units can be combined freely up to a point, but subject to rules which he is exploring" (109) and Miller, in his forward, comments that Anthony's activities are "a kind of self-imposing drill -- a playful drill, admittedly -- that must serve to bring what he already knows up to a level of complete automaticity" (16). Such views can be extended to phonology.

One common form of sound play is commutation, i.e. ringing the changes on a particular sound in a particular slot, such as replacing a vowel in a particular word with other vowels. For example, Otto Jespersen reported that his son Frans at 2;3 "amused himself by rounding all his vowels (o for a, y for i)" and at 3;1 by changing all the words of a line (of verse he had learned) to begin with d (Jespersen 1922:149). This kind of play is

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[7] In spite of recognizing seven Hallidayan functions (205) and identifying seventeen types of speech act (209) in his data, Scollon nowhere treats play as a separate category or set of categories. Once, in discussing grammatical constructions, he characterizes replacement sequences as "apparently a form of play in which the possibilities of systematic construction are explored" (201) but he does not apply the category "play" directly to Brenda's behavior and does not mention play in connection with phonology.

especially pleasurable when the child happens to hit on a real word in running through the commutation. Canta, Y.R. Chao's granddaughter, sometimes played with tones by taking a syllable and running it through the four tones of Mandarin Chinese, and Chao reports she was "surprised and amused" when she hit on a real word, in this instance a semantically related one, Chao 1973:28. Keenan 1974 reports similar instances in her twins' dialogues, which they greeted with "enormous hilarity."

-- ʃa batʃ

-- batʃi bitʃi badi bidi babi

-- badi [body] (laughing) (Keenan 1974:171)

Although all this play seems to be done for the fun of it, what better way could a child find to explore the phonotactic constraints of the phonological system being acquired?[8]

In various patterns of pure sound play the word, the syllable, or the phoneme may be the focus of repetition, commutation, or expansion. Some patterns involve mostly or exclusively real words, others have more or less nonsense material. The most frequently cited example from Weir is Anthony's pet phrase blanket like a lipstick with its interplay of stops and /l/. The sequence l...k occurs in each word, with a labial stop next to the l and an alveolar stop next to the k in the first and third words, and the consonantal play is enhanced by the prosodic and vocalic asimilarities. Examples from Weir and Keenan will illustrate different patterns. (Full phonetic transcriptions for all of them appear in the original sources.)

Weir	Keenan
bink (2 x)	--doo
let Bobo bind	--(laughing) dooch
bink ben bink	--doo (repeats over and over)(pause)
blue kink	--fuppy doo
no good	--wake up
nong good	--hake ut (laughing)
nong goos (2 x)	--hake ut
	--bake up
	--brake ut brake up
	--wake up week up (laugh) week up
[ɛ·g yɔ· bia·m]	--[gi:nɔg] (3 x)

[8]Play of this kind can be used by experimenters to obtain evidence of phonological competence and awareness, and might even be tried by speech specialists interested in accelerating a child's phonological development or improving a child's deviant phonology, just as many psychologists and recreation specialists have devised kinds of play to assist in the child's physical or emotional development.

[yɛm yə::m]	--[gi:nar] (repeats over and over)
[lam::]	--(laughs)
[li:]	--[ki:tar] (2 x)
[blɛm yi::] (2 x)	
[yam]	
[yi:::]	

The Keenan description of sound play is clear. She sees it as a part of children's acquisition of conversational competence and as evidence of children's growing ability to "attend to the formal features of one another's utterances" (183). She suggests a partial formalization of discourse procedures for young children which includes provision for non-referential sound play. Thus, the two best descriptions of sound play (Weir and Keenan) propose somewhat different rationales for it. To be sure, the sound play of the Keenan dialogues differs from that of the Weir monologues in having long stretches of nonsense word exchanges and, as might be expected, in having interruptions and attempts to gain attention, but the kinds of phonological relations between successive utterances are essentially the same in both.

Why do young children engage in expressive sound play? Why is it fun? It seems to us that sound play has the same rationale as other kinds of play. Like the young of other mammals -- only more so -- human children find pleasure in slightly novel objects and events and enjoy repeating them and varying them within behavioral frames common to the species. Further, they enjoy doing so in interaction with others. Since such behavior seems to improve the ability to cope socially with the needs of normal adult life, the selective advantage of the trait is not hard to imagine, and the increase in play going from non-mammals to mammals to primates to humans is an apparent evolutionary phenomenon. Since control of the phonological system of the language of one's community is necessary for almost any function of language, it is not surprising that phonological play takes place, and it is plausible that it contributes to skill in control of the system itself as well as contributing to other abilities, such as the use of language for poetic and metalinguistic functions and the phonological aspects of the management of conversation.

The immediate relationship of phonological play and phonological development is, however, not unidirectional but circular. As children acquire new vocal skills they have new resources to play with; as children play with speech sounds they consolidate and extend their control over the phonological system. It is difficult to go beyond this kind of commonsense speculation in the absence of many more descriptions and experimental studies. Our ignorance of the nature, amount, and conditions of occurrence of expressive sound play is great. Weir thought that Anthony's pre-sleep playful monologues were typical child language behavior, only to discover that her younger son did not engage in it. Keenan seems to think that the playful morning dialogues of her twins are typical of child behavior, but Garvey reports relatively little sound play in the dyadic interactions of her young subjects. Existing diary studies and child discourse texts can undoubtedly be mined more thoroughly, but we really need new studies that directly examine the phenomena of language play.

Of particular importance is the investigation of sound play in communities that are linguistically and culturally different from urban, middle-class, Euro-American settings. Schieffelin's (1979) study of the acquisition of communicative competence among the Kaluli in New Guinea is an instructive example. She observed young children engaging in sound play but found that mothers disapproved of it, called it obɛi towɔ 'bird talk' and stopped it. She reports that "the Kaluli see the process of language acquisition as a 'hardening' process. Mothers encourage their children to speak 'hard' talk, ...[and]...to ensure that 'hard language' develops, the mother ... terminates the sound play. She makes it explicit to the children that they are to speak 'good talk,' not 'bird talk.'" In the same vein, mothers do not allow older children to imitate young children's speech. Once children's speech is sufficiently hardened (about 3½ years) they are free to play with words so long as they do not do so in the presence of younger children.

Finally, if we observe that sound play is common in children's language behavior and if we assume that it assists in the acquisition of phonological competence in their mother tongue (L1) it is reasonable to hypothesize that sound play would occur with a similar function when children acquire a second language (L2). Some supporting evidence comes from a study of two seven-year-old boys. Angel, a Spanish speaker from Mexico, and Joe, and English speaker in Los Angeles (Peck 1979). "Through sound play in which Joe mocks Angel, and sound play in which both boys enjoy themselves, Angel is practicing and probably learning something about phonology" (395). This interesting and insightful study should stimulate further research along this line which could confirm the hypothesis and add to our understanding of the role of sound play in L1 and L2 phonological development.

1.4 Language games

Developmentalists have often noted that as children grow older many of the games they play become more elaborate and the rules of the games become more conscious, explicit, and socially prescribed. Indeed Piaget and his followers see the early, unstructured play as pure "assimilation" showing the limited cognitive development of the child whereas they regard the social play of older children and adults as evidence of greater cognitive competence and rational behavior. [9] This same sequence may be observed in the development of language play in the child, and in this section we will examine some language games with rules played by older children.

The best described of the various types of sound-based language games is the "secret language" or "play language" (PL), as exemplified by the familiar Pig Latin of American English speakers. A game of this kind typically has a single rule or small set of rules which has as its input a word of ordinary language and as its output the properly altered form of that word in the secret language. Thus, Pig Latin has the rule: "Move the initial consonant of the word to the end of the word and add the vowel sound ay" and the

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[9] This view of play development has been sharply criticized on various grounds (e.g. Sutton-Smith 1966, Schwartzmann 1978) and we are not endorsing it here except as a convenient frame of reference.

rule when applied to pig yields igpay.[10] Games of this sort are widely attested, with examples from every continent and in dozens of different languages (Jespersen 1922:149-150, Haas 1969, Sherzer 1976).

The range of phonological processes applied in such PLs and the social functions of PLs have been analyzed in some depth. Typical processes are in terms of syllables or consonants and include:

process	comment	example
1) syllable addition	commonest type adds a whole syllable either at one place in the word or after every syllable; next most common adds a syllable consisting of a new consonant and a vowel taken from the base word	Eng pig → igpay Span niño → nipoñopo Cuna pia → piriara
2) syllable permutation	commonest type moves first syllable to the end	Cun uwaya → wayau
3) syllable deletion	not so common; usually loss of non-initial syllable(s)	Jav arep → ar
4) consonant addition	commonest type = (1)	
5) consonant permutation	commonest type is exchange of first and last consonants in a syllable	Fr l'école → qu'élole
6) consonant substitution	commonest is replacement of initial or final consonant by the PL consonant; most complex is replacement of every consonant by another	Hanunoo rignuk → rignuŋ Jav gawe → rade
7) prosodic changes	include stress shift, length shift, added nasalization	

Some PLs utilize special material or information outside the base language. For example, a number of PLs make some use of the orthography of the language. This is true not only in highly literate societies (e.g. France, U.S.A) but in communities where the use of writing is very limited, such as the Hanunoo speakers in the Philippines (Conklin 1959). Also, some PLs make use of special vocabulary taken from another language (Price & Price 1978). Thus both the base forms and the phonological processes applied to them may go outside the normal structures of the spoken language from which the PL is derived.

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[10] Actually the rule is more complicated than this, since it must include provision for words with initial consonant clusters, no consonant at all, various stress patterns, inflectional endings, etc. There is considerable fluctuation in the application of the rule by users, i.e. "players" of the game.

Typical social functions of PLs include: concealing messages from out-group users of the base language, marking special group membership, exhibiting socially valued verbal skills, serving as socially approved channels for pleasure, and learning vocabulary and orthography. Sometimes a configuration of such functions has such cohesion that it may be identified as a specific social function, as in Hanunoo society where the use of PLs is primarily a feature of courting behavior (Conklin 1959). Hanunoo PLs are used primarily between pairs of marrigeable males and females, and their use by younger children or older married people seems to be either making fun of courting behavior or a nostalgic reenactment of it. Typically PLs around the world are used by adolescent groups, most often males, as a way of identifying membership in the group and excluding others, such as younger or older siblings, other family members, or other peer groups. Even in Saramaccan society where PLs belong to particular villages and are used by older people to exhibit verbal skills or prevent comprehension by people from other villages, observers have concluded that PLs generally have their origin in small groups of teenagers (Price & Price 1976).

Play languages have proved to be a productive area of research for linguists primarily because they provide evidence for behavioral units corresponding to abstract elements and relations of phonology such as syllable, segment, underlying representation, phonological rule, rule ordering, cyclical application of rules. For example, they give evidence for the operation of particular rules by providing new segmental combinations to which hypothesized phonological rules may apply. (For discussion of PLs in the light of phonological theory cf. Halle 1962 and especially Sherzer 1976.) They are also valuable in showing that at points where linguists have difficulty in agreeing on the "correct" units, representations, or rules, the users of the PL often also show vacillation and alternative options. PLs present a challenge to phonological theory in that some of the typical processes operating in them are rare or non-existent in ordinary synchronic phonologies and in diachronic change. For example, consonant metathesis occurs under fairly limited conditions in natural languages (Ultan 1971), but the kind of wholesale permuting of syllables or segments common in PLs seems not to occur in natural languages.

The interest of PLs for developmentalists, and in particular child phonologists, is twofold. As noted above (p.152), the rules of PLs offer striking evidence of children's ability to apply very precise phonological rules, sometimes of quite complex character, to the word shapes of a language and to do so with considerable fluency in actual communication situations. Further, the rules of the game, although precise and socially prescribed, are often neither explicit nor formally taught, but are acquired "naturally" by observation and use in communication. Particularly valuable would be studies of children's acquisition of these games. In the sizable literature on PLs which has come to our attention we have not found a single study in which children's use of a particular PL is followed developmentally (but cf. Day 1973 which uses laboratory acquisitions of PLs as a research tool). Some experimental data would also be valuable: At how early an age can children master the use of a PL? Which types of PLs are easiest to acquire? How well do users comprehend the messages in PL exchanges?

The second aspect of interest for the developmentalist lies in the acquisition of social rules in general. The PLs of a speech community or of social groups within the community are part of the total repertoire of language

structures and uses which must be acquired by members of the community/group. Just as each language presumably has a unique phonology, each speech community has a unique repertoire of conventional sound-based language games, and it is surely of interest to explore the range of possibilities and the nature of the differences between language/communities. Children simultaneously learn how to do phonology and how to do the phonology of a particular language, how to engage in verbal play and how to engage in the verbal play of a particular community.

Social play in the sense of conventional games with explicit rules probably has its origins (ontogentically) in mother-child interaction routines in infancy (Garvey 1977b:105; cf. the persuasive account of peek-a-boo in Bruner & Sherwood 1976). The infant is simultaneously learning the particular game and learning how to play games. Infant games of the peek-a-boo sort in which there is a sequence of attracting attention, performing a certain movement, uttering the appropriate vocalization,[11] and expressing pleasure at completion are very widespread. The exact details of the movements and the vocalizations, however, differ considerably from one speech community to another, with corresponding differences in these very early sound-meaning pairs being learned. Also, the rules of the games being acquired become part of the child's repertoire which can be used with others and finally, when the child is grown up, can be used with infants, thus transmitting the cultural content of the community.

In both of these aspects of language games--as evidence of the operation of phonological rules and as locus for learning social rules--we must note that the games and rules are not rigid. They allow for the kind of theme-and-variation behavior typical of play as well as for individual differences in verbal ability and the emergence and spread of adaptations which constitute linguistic and cultural change.

In this limited discussion of sound-based language games we have examined play languages and suggested their origin in mother-infant routines, but we have not attempted to discuss the many other kinds of games. For example, in the Middle East children and adults play a game of quoting proverbs or lines of verse in which the player must produce an item which begins with the same sound (or letter) that the preceding item ended with. Many speech communities around the world have gibberish rhymes in which some, most, or all of the rhyme is composed of phonological possible nonsense "words" which do not occur in ordinary talk and have no semantic value. Such games and the many others which appear in the literature could also be investigated in reference to phonological development. It is conceivable, for example, that the quoting game, which requires conscious recognition of identical sounds serves to develop the child's metalinguistic (phonological) awareness (cf. Cazden 1974, Read 1978) and that the recitation of gibberish rhymes consolidates the unconscious knowledge of phonotactic constraints (Greenberg & Jenkins

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[11] The vocalizations or "game cues", which typically serve also as names of the game, are part of the lexicon of baby talk registers in many languages. Ferguson 1977 suggests that the games "may play a helpful role in the child's ability to recognize the...connection between vocal signal and referent" and that the cues may "constitute one of the sources of action predicates" (222), but does not mention phonological development as such.

1964, Messer 1967). What we need are developmentally focused studies of language games and experiments investigating phonological competence with respect to the games.

2.0 COGNITION

Linguistic research in child phonology of the past decade or more has been dominated by two central ideas about children: first, the child is largely a passive organism in which development unfolds; and, second, the child is simply a scaled-down version of the adult. Both ideas stem largely from the presumption of universals of language and of acquisition. Because the phonology of a child was assumed to be quantitatively simpler than that of the adult and, at least at the early stages, universally the same across languages, linguists looked to child phonology to answer questions of interest to linguistic theory. Generally, the formalisms of linguistic theory were adopted for the analysis of child data and in large part dictated not only the questions of interest but also the methods of data collection and analysis. In short, the focus of these analyses was on purely linguistic regularities in the child corpus.

During the last ten to fifteen years, three competing theories of acquisition have dominated linguistic research on child phonology and these three are essentially variants of a universalist theory with each being an extension of a particular phonological theory.[12] (1) Jakobson 1943 (translated into English in 1968) was the first to put forth a general theory of the acquisition of phonology based on linguistic universals. Jakobson's theory is by far the most influential of the various universalist models, and the data from many children, acquiring a wide variety of languages, have been analyzed as conforming to the general Jakobsonian outline of development. Although this theory has been criticized on many grounds (e.g. Olmsted 1966, 1971, Ferguson and Garnica 1975, Kiparsky and Menn 1977, Macken 1978a), it is often quoted as if it were fact (e.g. Mikeš 1976). Moskowitz (1970, 1973, and 1978) includes elements of classical generative phonology but essentially is a revision of Jakobson and thus structuralist in form. (2) The leading figure working the classic generative phonology paradigm is Smith (1973, 1974, 1975, 1976). Smith 1978 presents some revision of the earlier work (partially as a response to criticisms in Macken 1979a), but the general universalist framework remains the same. Dodd 1976 is an example of a work within the Smith-type model. Generative phonology (with its subsequent revisions) has also provided key concepts that have been used to advantage in the child phonology literature: for example, Ingram 1974 applied the notion of ordered rules (cf. also Stampe) and drew on Stanley's 1967 discussion of redundancy rules (cf. also Menn 1974); Jones 1967 was based on the work of Halle (and Jakobson), and Menn 1971 attempted to handle the problem of child surface structure constraints within Jones' system; and Branigan 1976 applies the notions of constraints (Ross 1967) and conspiracies (Kisseberth 1970) to child phonology. (3) Stampe 1969, 1973 presents a new theory of phonology--"natural phonology"--which emphasizes universal, innate natural processes

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[12] Outside the universalist school are Olmsted 1966, 1971, who extended the behaviorist theories of Mowrer 1952 (see also Winitz 1969, Murai 1963 and Timm 1977) and Waterson 1970, 1971, who works within the Firthian prosodic analysis theory (one of the few approaches to emphasize individual differences).

and includes an explicit acquisition theory based on these processes (cf. also Donegan and Stampe 1979). Edwards (1978a, 1978b, and 1979) is a major proponent of the Stampean model. Hooper 1977, following the "natural generative phonology" model, is an example of the application of child data to controversial questions in phonological theory (cf. also Venneman 1971).

This universalist, linguistic-theory-dominated decade has been highly productive in a number of ways. A great deal of information has been amassed on the sounds and the substitutions that children produce, the order in which segments and rules are acquired, and the acoustic and articulatory principles on which these sound patterns are based. The attention drawn to child phonology by Jakobson, Chomsky-Halle, Stampe and others and the impressive contributions of the research of this decade to linguistics have firmly established child phonology as a legitimate subfield of linguistic inquiry. Increasingly, however, data have been collected that cannot be handled within the universalist-linguistic framework. The anomalous data include evidence of widespread individual differences between children acquiring the same language (and also differences across languages) and evidence (particularly from 'recidivism' or apparent loss of an ability) that the acquisition process is not a linear progression of unfolding abilities.[13] An identifiable shift is in progress toward a more cognitive model of phonology acquisition. The central focus is now on <u>learning</u>--not the automatic, mechanistic form of learning advocated by the behaviorist theories of the 1930-1950's, but an <u>active</u> form of learning in which the child acts on environmental input to 'create' knowledge (albeit, always within constraints of human structures and processing capabilities). The child is now seen as an active seeker and user of information--an active hypothesis-generator. Child phonologists increasingly look to syntax and semantics acquisition studies and to developmental and cognitive psychology for parallels, analogies, and formalisms rather than solely to linguistic theories of the organization of adult phonology. This newer research (with its forerunners) constitutes a shift in focus from purely linguistic regularities to linguisitc regularities that reveal the processing carried out by the child.

Contrasting the cognitive model to the universalist-linguistic model is misleading in at least three senses. First, it erroneously implies that previous work in child phonology was not concerned with psychologically real units, rules and stages. Most child phonologists evaluated competing units of analysis (e.g. features versus segments) by evidence that the child <u>used</u> them (e.g. the discussion as in Moskowitz 1970 against the feature on the basis of its non-generalizability, cf. also Smith 1973 and 1974 which present evidence intended to establish the psychological reality and, hence, validity of the particular rule system adopted for A's speech). Secondly, such a contrast is misleading in its suggestion that the cognitive model of phonology acquisition is not concerned with linguistic universals. Although the shift is toward, for example, universal constraints on hypothesis-formation and a universally valid developmental model, the search for specifically linguistic universals continues (e.g. Macken 1978a and Vihman 1978).[14] Finally, it is

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[13]There is also data that would suggest that the child's organization of phonology is qualitatively different from the adult's, but we will not deal directly with this issue here.

[14]It is ironical that it has been data on individual differences that

misleading to even label the new trends as a model--cognitive or otherwise. Certainly, many child phonologists have moved away from the strong form of universal acquisition theories such as those of Jakobson and Stampe. Likewise, many researchers have abandoned attempts to analyze the data from very young children in terms of the assumptions and specific constructs of 'classical' Chomskian generative phonology. But those same reserachers have varied in the directions of change that they have taken. The trends hardly constitute a fully developed model. The change is not dramatic (certainly not nearly as dramatic as the change that occurred between the structuralist and Chomskian periods) and for the most part must be inferred from the organization and analysis of recent papers. The most explicitly articulated cognitive model is found in a paper by Kiparsky and Menn, and this paper was only published in 1977 (see also Menn 1974, Macken 1976 and 1979b, Ferguson 1979, and Fey and Gandour 1979). The change goes back further than 1977 (as will be shown below), but even today a fully developed theoretical system and a consensus have not yet emerged.

That such a shift is taking place in child phonology is not surprising in that a similar shift has taken place in the field of child language development as a whole. Chomsky's claim of a highly specific 'language acquisition device' was countered at least as early as 1972 by Macnamara who argued for general skills that the child applies to language learning as well as to other complex tasks (cf. the even earlier proposals by Slobin 1966 and Fodor 1966 of general analysis procedures). The specifically linguistic LAD has been replaced by an impressive 'hypothesis-formation system'. The attribution of such sophisticated reasoning abilities to the child is itself a major departure from the previously widely-held Piagetian view of limited intellectual capabilities in the child under seven years; again, it has been largely the research of the 1970's that has led to the demise of this view of the young child's abilities (cf. Donaldson 1978 and Gelman 1979).

In spite of the similarity, the shift to a more cognitive model of child phonology is surprising at least in part because phonology is typically thought to be less cognitive than, say, semantics or word use (but see, for example, Sapir 1925). At its extreme, this assumption translates to a view of acquisition in which learning to pronounce is a lower-level skill more directly constrained by anatomical and physiological characteristics of the human auditory and articulatory tracts. Terminology often reflects the pretheoretical concepts of the practitioners in a field, and the terminology of phonology is a specialized system quite divorced from traditional cognitive terms like categories, concept formation, mental models, understanding, etc. Whether intentional or not, child phonologists create a picture of acquisition that is quite mechanical, simply by the use of their terminology and formalisms. Yet, a "phoneme" can be viewed as a category, a "rule" as a mental representation for the organization of categories and "the acquisition of phonology" as the way in which the child learns to form categories, recognize patterns, form rules on the basis of those patterns and reformulate hypotheses on the basis of new data and counter examples. It is significant that in many recent child phonology articles, terms like 'phoneme' and 'phonotactic filter' have been replaced by or subordinated to terms like 'final-position focuser', 'favorite sounds', 'hypotheses', 'strategies' and 'word-

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has propelled the shift toward a cognitive model in phonology acquisition, since cognitive models in psychology tend to ignore individual differences.

pattern preferences'. Although the traditional constructs are not abandoned, the newer terminology reflects a change in the underlying conceptions about children, their capabilities and the nature of the acquisition process: (1) from the child as passive to the child as active (section 2.1); (2) from a child with limited intellectual abilties to a 'creative' child with quite flexible reasoning, inferencing and learning abilities (section 2.2); and (3) from acquisition as pre-determined stages to acquisition as processes of hypothesis-forming and testing (section 2.3).

For reasons given earlier, it is premature to fully extend the analogy of phonology acquisition as a cognitive, categorization process. We discuss here, however, the data suggestive of a cognitive model, first because there has been a shift toward such a model and we view this shift as accurately reflecting the empirically valid assertion of cognitively relevant aspects of phonology acquisition. In addition, we hope to re-focus attention on some critical aspects of acquisition that were largely ignored in the research generated by the universalist-linguistic model. As is typically the case, no one model handles all the data, and we discuss at the end of this section some limitations to a cognitive approach.

The material is organized under three headings: selectiveness, creativity and hypothesis formation. Selectiveness refers to preferential strategies in the exploitation of input, or the child as a highly selective seeker of phonological information. The child avoids, selects, or makes favorites of particular phonological characteristics of the language as a basis for his/her own active use. Creativity refers to the child's creativity, not the usual linguistic sense of producing novel sequences on the basis of a limited set of rules, but in the sense of creating segments or patterns which do not occur in the adult phonology at all. Finally, hypothesis formation refers to the child's formulating, testing, and revising of hypotheses about the phonological structure of the language.

2.1 Selectiveness

Evidence for active selection and/or avoidance of words with a particular structure was--with the documentation of widespread individual differences in phonology acquisition--one of the earliest findings that indicated the active role of the child during acquisition. Engel 1965, Drachman 1973, and Ferguson and Farwell 1975 (and since then several other papers) present data that appear to demonstrate that children can be highly selective in deciding what words to produce and, further, that the choice is at least sometimes made on the basis of how easy or difficult a word is to pronounce. First, these studies have found that there is a close correlation between the types of words children can say and the types of words they attempt. Second, it is argued that the distribution of word types in the child's vocabulary does not reflect that found in the adult vocabulary, nor could the child distribution have occurred by chance. The conclusion drawn is that the children have actively chosen or avoided words with particular sounds or sound structures. Although some aspects of the avoidance/selection hypothesis have been criticized (see Macken 1978a), and although not all authors have been able to document it (see Leonard and Newhoff 1978), supportive evidence for it has been found in the data from a number of children acquiring a variety of languages (e.g. Estonian, Vihman 1971; English, Farwell 1976 and Labov and Labov 1978; Finnish, Itkonen 1977; and Spanish, Macken 1979b). A particular

sub-type of selection that has been reported is one in which the formation of a new 'output pattern' (i.e. a new way to combine particular consonants and vowels) is immediately followed by the acquisition of new vocabulary items which in the adult form structurally resemble the child's output pattern (e.g. Branigan 1976; Vihman 1976; Menn 1976; Macken 1979b). This correlation is interpreted to mean that once the child figures out a new articulatory routine, he/she looks for or is especially receptive to new words that can be handled with the new routine.

Evidence like the above, that suggests that the child selectively attends to input stimuli, draws largely on the differences between the child corpus and that of the adult language. We will cite, below, differences between individual children as the main evidence for the child as a creative user of information and differences in stages within a single child's corpus as the main evidence for the basic constructive--or hypothesis-forming--nature of the acquisition process. However, all three types of evidence overlap: for example, evidence for the child's creativity also is evidence for the child's active role in the learning process, and children's 'created' segments and word patterns also demonstrate the rule formation process. In all the examples, the focus is on novelty, the creation of knowledge, the non-automatic nature of child responses and the non-linear nature of the progression to the adult norm.

2.2 Creativity

The most striking evidence for the creativity of the child comes from cases where children produce segments or word patterns for which there is no distinct model in the adult language. In each of these cases, a child has formed an hypothesis about possible segments or permissible sequences that is plausible given the child's existing system or certain properties of the adult system but is incorrect from the adult point of view and is unique or nearly unique to the child in question. An example of the creation of a novel segment is reported in Macken 1979b, where a monolingual Spanish-speaking child, referred to as Si, (at 2;0.7) expanded the class of permissible word initial velar consonants to include a velar nasal, possibly on analogy to her previously established class of possible word-initial labial consonants which included both stops and nasals. The velar nasal is not a phoneme in adult Spanish and only occurs under certain assimilation conditions. Si's phonemicization of the velar nasal is incorrect by adult standards and unique among the six Spanish-learning children studied by Macken; however, it is a plausible extension of Si's rules for the formation of possible words. A similar case can be found in Ferguson, Peizer and Weeks 1973 where a child named Leslie who was acquiring English created a word-initial velar nasal that essentially filled a gap in the English distribution of the velar nasal. These examples (and others like them) reveal the children's existing rule system and are creative extensions or hypotheses based on their (incomplete) knowledge of their respective language's system for word formation (or 'phonotactics'). An analogous case for the acquisition of syntax comes from Brown and Hanlon 1970: Adam, one of the children studies, produced the novel tag question "I'm magic, amn't I?". 'Amn't I?' should be a possible English tag but actually is not; its use by Adam, however, clearly demonstrates Adam's (incomplete) knowledge of the general rule system for the formation of English tags and his creativity.

Sometimes children's errors also provide evidence for non-adult

segmentation and categorization. For adult speakers of English, the word sweet apparently consists of four segments, the first two being [s] and [w]; for a number (but not the majority) of children acquiring English, sweet is at some stage apparently only three segments: sweet is produced feet (e.g. Greenlee 1973, and Barton et al. 1980 [this volume]). The production of [f] for [sw] is interpreted as a conflation in which features of two adult segments are combined into one child segment (frication from the s and labiality from the w), in other words, a failure by the child to segment the input in an adult-like fashion. There are many examples of such conflated units (or non-adult segmentation) at the morphological level in the lexicons of children: Si, the Spanish-speaking child mentioned above, lexicalized the article la 'the' and a noun in one case--[nanina] for la niña 'the girl' (Macken 1979b); Tessa, a child studied by the CPP at Stanford, regularly produced [pʰɛtʰɔn] for pants (from pants on, according to her father);[15] R, another Spanish-speaking child studied by the CPP, had a favorite 'word' [kikeko] derived from the Spanish sentence ¿Qué es ésto? 'What is that?'; Adam considered it's to be one word (Brown 1973); and the three children in Farwell 1974 all treated what's that as a single unit (see Berman 1977 for examples from a Hebrew-speaking child). Examples like these can either be unique to a particular child (as in the Si, R and Tessa examples) or may be fairly common (as the it's example probably is) but, in any event, demonstrate--like the [sw] example--that children must learn to segment the acoustic input lexically, morphologically, and phonologically.

Categorization, like segmentation, requires making judgments of phonetic similarity across items. The categorization is difficult to prove if the child's production is quite close to the adult form. For example, children acquiring English often produce /tr/ as [tʃ] (e.g. tree as chee); this may mean that these children are categorizing adult /tr/ and /tʃ/ as similar/the same, or it may mean that the production of the highly affricated [tʃ] only is the child's attempt to replicate the strong frication that does occur in adult production of /tr/. In the latter case, the child's [tʃ] for both /tr/ and [tʃ] does not necessarily imply a category based on a similarity judgment. However, sometimes we do have evidence for categorization based on a similarity judgment: Amahl produced /tr/ correctly but produced initial /tʃ/ as [tr] (so tree is all right but chalk is [trɔk]) (Smith 1973). Presumably, there is nothing in the adult production of chalk that a child could interpret as [r]; thus, we infer that the anomalous [r] in chalk is due to Amahl's categorization of English /tr/ and /tʃ/ as similar.

The data from individual children often provide examples of novel 'word patterns', i.e. the strategies that a child devises for the sequencing of particular consonants and vowels. When a child discovers a pronounceable sequence, he/she uses it as a general pattern for many other words. Si's earliest word pattern was [C1-V-C2-V], where the first consonant was a labial consonant, the second consonant was a dental, and both vowels were the same. She used several rules for achieving this output, one of which was 'metathesis' (or switching the adult order of consonants). Furthermore, when she devised a new pattern, she would add words to her productive vocabulary--words that roughly 'fit' her new pattern, and she would occasionally change the pronun-

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[15] Tessa later added [pʰænts] to create her own unique contrast between pants/trousers [pʰænts] and underpants [pʰɛtʰɔn].

ciation of some old words to fit the new pattern (Macken 1979b). J, another child in the same Spanish study, kept the ordering of consonants the same as in the adult model but used 'harmony' (changing the place of articulation of a consonant) to insure that any two consonants in a word were the same (Macken 1978b). More examples could be cited to demonstrate the diversity of very young children's created rules (see, in particular, Braine 1974 and Ferguson, Peizer and Weeks 1973), but two particularly unusual ones are the following: the child in Priestly 1977 produced adult disyllabic words as [CVjVC] (e.g. sucker as [fajak] and cupboard as [kajat]); and A in Smith 1973 went through a stage in which he produced initial unstressed syllables as [ri-] (e.g. guitar as [ri ta:]).

Also evidence of the very young child's creativity are invented words. Ferguson 1978 calls these inventions "vocables": "at some point in the babbling period, the child typically begins to make active use of sound-meaning correspondences of his own, i.e. he produces a set of vocables which function communicatively much like the later 'first words' but are not based on words of the adult language". Ferguson cites an example from a German diary study when a child used a long [m] to mean 'here comes a wagon' or 'I hear a wagon'. Halliday 1975 reports that his son at 10 month had eleven or twelve expressions in more or less consistent use, and only one ([bo], roughly 'give me my bird') had an obvious source in the adult language. (See also Menn 1976 on "proto-words".) Examples can be cited from children acquiring many different languages (e.g. Norwegian, Vanvik 1971 and Hindi, Srivastava 1974), and the phenomenon is not restricted to oral language: Goldin-Meadow and Felman 1977 report that deaf children spontaneously develop a structured sign system that has many of the properties of natural spoken language, and that this system is "largely the invention of the child himself, rather than of the caretakers". Peters 1974 discusses words invented by children (i.e. words with no apparent adult models) and reports that "most children seem to have invented at least one word". An analogous invention in the area of syntax comes from Kunsman 1976 who reports on a child who used reduplication as a means of expressing negation prior to the use of no: Father: "Want to go to bed?", child: "betiti" (i.e. no bed); Child: "shoesisi" (gloss--Don't put on my shoes).

2.3 Hypothesis formation

Universalist theorists assume the acquisition process to be constrained by innately given principles that effect an orderly progress of improvement toward the adult model. For example, Jakobson (1941/1968) observed a set of stages in the data from children acquiring various languages and explained these stages in terms of a universal hierarchy of structural laws based on feature contrasts; these 'universals' in effect function like a filtering device that automatically sequences acquisition. These general 'universals' stem (in part) from the fact that all children possess roughly the same human auditory and articulatory apparatus. However, Jakobson's model--like universalist models in general--predicts that the child's output at any given time period is systematic and that changes in the output across time will be similarly systematic and progressive.

If we look closely at the corpus from a given child, we find, however, significant variation in addition to systematicity. Some of the variability in a child's corpus will not concern us here (as, for example, the phonetic range [s̪, s, ɕ, tʃ...] found in a particular child's productions of English /s/). The types of variation that will concern us are those that present

clear problems for a universalist model and simultaneously provide support for some kind of more cognitive model. Clearly, evidence of individual differences between children is a convincing argument against a universalist model: documentation of such differences is now extensive and has been drawn upon in critical evaluations of universal theories (e.g. Kiparsky and Menn 1977, Macken 1978a). Since our goal is to also provide an overview of the kinds of data that are leading researchers to a consideration of a more cognitive model, we will here deal only with within-child variation, because it is such within-child variation that appears to reflect most clearly an underlying process of active hypothesis (or, rule) formation on the part of the child.

Isolated accuracy. Occasionally, a child will produce an early word in a quite accurate form; Moskowitz 1973 calls these cases of isolated accuracy "progressive idioms". The prototypic case is Hildegard Leopold's pretty. This word was Hildegard's first permanent word (at 0;10), and she pronounced it with near perfect phonetic accuracy for nearly a year. Then, however, it changed to [prti] and a month later to [brdi]. These latter two changes occurred when rules of consonant cluster reduction and consonant voicing (respectively) appeared elsewhere in her system (Leopold 1947). In cases like this one, a word (or sound; cf. Itkonen 1977) is produced accurately and then loses its accuracy at about the time that a rule 'appears' in the child's system (see other cases of 'regression' or loss of accuracy below). The early, accurate pronunciation is taken to be an unanalyzed whole and evidence of a pre-rule stage (as distinct from regression due to changes in rules, below). A parallel from semantics is 'underextension' where a child produces a word correctly in an isolated context, but where the concept represented by that word remains outside the child's semantic system, as for example Hildegard's early use of white for the color of snow only.

Experimentation. The CPP has recorded many children (usually at weekly intervals) in the ten years of its operation. Occasionally on these tapes are examples of variation that were interpreted by the adults present at the time of utterance as deliberate effortful attempts by the child to find an acceptable (to the child) way to say a word. Similarly, during the analysis, these examples were interpreted on structural grounds as evidence of experimentation preceding an innovation. That these examples are not common on the tapes is attributable at least partially to the problem of sampling interval. The same explanation may hold for the rarity of such examples in the literature, although it may also be the case that when an author is working within the assumptions of a universalist model, such cases of variation are judged anomalous or irrelevant surface phenomena. Nevertheless, the relative rarity of such crucial examples is a problem for the cognitive model, a point to which we will return.

Table 1 gives two examples of experimentation from CPP children. With regard to the first example, Tessa's productions on sessions 1-3 show the final /t/ in boat deleted or replaced by [ʔ] (as were all final stop consonants). On session 4, the first examples of velar consonant harmony appeared (coat [kʌk] goat [kʌ˞k]), and her productions of boat indicate a search for a rule to handle initial labial/final alveolar words. The subsequent sessions were characterized by widespread use of velar and labial harmony. An interpretation of these data is that Tessa was, on session 4, experimenting with two solutions to the problem posed by the structure of boat: (a) treat final

Table 1. EXPERIMENTATION: Tessa's boat, session 4 / Si's elefante, session 10

	Child[1]	Target	Session	Phonetic transcription[2]	# of productions	Age
A.	Tessa	boat	1	[p°ɔ/o]$_{3x}$, [p°ɔ2]	4	1;4.28
			2	[p°ɔ]$_{4x}$, [p°ʌ2]	5	
			3	[p°ɔ]$_{3x}$, [p°o/ɔ2]$_{3x}$	6	
			4	[p°ɔp^h k^h] [p°op^h] [p°ʌp̃ p^{h}ɣk̃] [p°ʌk^h]$_{2x}$ [p°ɔk^h]$_{2x}$ [p°ɔk^h k^h]$_{2x}$ [p°ap^h k^h] [p°ʌk^h k^h]	11	1;5.30
			5	[p°ɔp^h]$_{2x}$	2	1;6.15
			6	[p°op̃], [p°o2]	2	
			7,8	-	-	
			9	[p°ʌp]$_{3x}$	3	
			10	-	-	
			11-16	[p°ot^h], [p°ot̃]	2-3x/ session	1;9.2
B.	Si[3]	elefante 'elephant'	10	[hwan t°u t°i] [pf an t°ɪn dɪ] [p° an t°i] [b an t°ɪn di]	4	1;9.12
			12/13	[p°a t°e], [p°an t°e]		1;10.2

NOTES

(1) Both children were subjects in CPP studies

(2) Broad segmental transcriptions, simplified from originals

(3) Macken 1979b. 33-34.

/t/ as [k] or (b) harmonize final /t/ to initial labial. The subsequent data show that she settled on (b). In Table 1 under B are data from another CPP subject--Si. The experimentation shown in these data is associated with the production of a new word in her active lexicon. Three of the variable forms of session 10 were both longer and more complex than any other words from the same session; these were replaced in session 11 by a single form [pate], the structure of which was fully consistent with the structure of the rest of her words. (Later, Si produced [pante] during the stage in which she (re-) acquired the nt cluster.)

The variation seen in 'idioms' and 'experimentation' precedes the stage in which particular words are produced in a form that is stable and systematic with respect to other words of a similar type. Such variation demonstrates that at least some aspects of acquisition are not automatic. The onset of systematicity is increasingly viewed as evidence that the child has 'discovered' or 'invented' a rule. Stronger evidence that the child's rule constitutes an hypothesis or 'theory' about the relationship between several items in a system comes from the phenomena of 'overgeneralization' and 'regression'--two (partially overlapping) types of variation that are as difficult for the universalist model to explain as the variation seen in idioms and experimentation data.

Overgeneralization. Overgeneralization is a term applied to cases in which the child extends a rule for a particular set of sounds or words to a set of sounds or words where the extension is inappropriate from an adult point of view. Table 2 charts the development of stop + /r/ clusters in the speech of Jane, a 1976 CPP subject. From 1;6.9 to 1;10.7, Jane reduced initial stop + /r/ clusters by deleting the /r/ (n.b. adult initial singleton /r/ was [w] for her). From 1;11.0 to 1;11.14, initial /tr/ and /dr/ were produced as [f]. Evidently the strong aspiration combined with labiality (in the /r/) in adult pronunciation of /tr/ and /dr/ led to the child's decision to switch from [t] to [f] productions for /tr/ and /dr/ (cf. 'Changing hypotheses' below). To this point, Jane's rules operate on classes of segments sufficiently close to the adult classes that the process is 'rule formation'. However, at the next stage, 1;11.28 to 2;1.16, Jane uses [f] for all initial /pr/, /tr/, /dr/ and /kr/ words. The extension of [f] to /pr/ and /kr/ is 'overgeneralization'.

Overgeneralization is distinct from simple 'rule formation' (or 'generalization') in the following ways: (1)the extension is to items more clearly inappropriate from an adult point of view;[16] and (2) the newly included sounds involved were closer to the adult model before than after the extension (e.g. [k] is in a sense more 'correct' for /kr/ than is [f]). Both rule formation and overgeneralization must have a plausible phonetic or phonological base (however distant from the adult language) to qualify as rule-governed behavior. A further restriction, for the present, is that the rule of overgeneralization be fairly uncommon among children acquiring the same language; this is to insure that the case for active rule formation draws on only the clearest and strongest examples.[17]

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[16]Although the original inclusion of /dr/ with /tr/ is also an 'error' from the adult vantage, /tr/ and /dr/ form a more natural set for the adult language than a set comprised of /pr, tr, dr, kr/.

Table 2. OVERGENERALIZATION: Jane's pr and kr, session 13

Adult Clusters \ Session Age	CHILD FORMS 1 - 9 1;6.9-1;10.7	10 1;10.14	11 - 12 1;11.0-1;11.14	13(2) - 16 1;11.28-2;1.16	Home Visit(3) 2;6.1
pr	([p°]ɹ) [p^h] 1;9.15	[p^h]	[p^h]	[f]	[p^{h}w]
tr	([t°]ɹ) [t^h] 1;9.15	[hw](4)	[f]	[f]	[f]
dr	[t°]	?	[f]	[f]	[f]
kr	([k°]ɹ) [k^h] 1;10.7	[k^h]	[k^h]	[f]	[f]
Examples	pretty [p^{h}ɪt^{h}i] → (5)			pretty [fɪt^{h}i] →	prune [pwun]
	trousers [t°auwɪs]	tree [hwi]	tree [fi] →		
	drawer [t°ɔ:] →	→	drink [fwɜŋk]	drink [fɪŋk^h] →	→
	cracker → [k°ɛk°ə]		→	cream [fim] →	→
				cradle [fedəl] →	→

NOTES

(1) Beginning on session 13, Jane overgeneralized her /tr, dr/ → [f] rule to include adult /pr/ and /kr/. Throughout this period, [f] is never produced in place of adult /br/, /gr/ or /r/ or for stops in any other environment.

(2) On session 13, Jane's mother commented " She's got those stop plus r [as] f....It's getting very difficult to tell what she's saying. It's just that she's generalized suddenly to everything. Bread is bed/ Pretty fɪtty....Cradle. You'll get fatal....Depends on the word...."

(3) At the home visit, Jane's mother confirmed the patterns reported, again helped elicit relevant words, and also commented: "Within the last few weeks, [Jane] has become aware that she doesn't say words like adults do. If I say to her "Are you [fɪŋk^{h}ɪŋ] your milk?", she smiles. She understands."

(4) Only one token.

(5) The arrow indicates a time period during which no change occurred in the example word.

Such phonological overgeneralizations are similar to those found in syntax and semantics as, for example, the use of *wented at the stage in which the past tense -ed is learned (and where the correct went was previously used) (Cazden 1968) or the extension of more + noun (more cookies) to more + verb (*more read) (Braine 1963).

Regression. Over fifty years ago, Jespersen observed that "sometimes a child will acquire a sound or sound combination correctly and then lose it till it reappears a few months later (1929:110)".[18] We will use the term "regression" to describe those cases in which a child, at one stage, produces a sound or sequence of sounds correctly (i.e. as an adult would) and then, at a subsequent stage, produces it incorrectly. In one sense, regression is the complement of overgeneralization: the use of the term 'overgeneralization' draws attention to the formation of a new rule, while the term 'regression' identifies the consequences of the child's new rule. In this section, we will restrict 'regression' to the loss of a correct production; in the following section, 'changing hypotheses', we will discuss examples where a change in the child's hypothesis takes the child's production further from the adult model than was the case in an earlier stage.

In the data from J--a Spanish-speaking child studied by the CPP--, the following five stages in the production of taza 'cup' were observed:

(1)	[ta]	1;9.15	
(2)	[tata]	1;11	
(3)	[tasa]	2;0	
(4)	[sasa]	2;1	
(5)	[tasa]	2;2	(from Macken 1978b; transcription simplified)

First, we observe that in stages 1-3, J produces the initial /t/ of taza correctly. Second, in both stages 3 and 5, J produces the whole word as an adult speaker of Spanish would. The interesting stage is stage 4: here, J has applied a rule of consonant (i.e. fricative) harmony which results in the loss of the previously correct initial /t/. In discussing data of this type, Macken refers to the phenomenon as one of "permitted complexity" and argues that the limits on complexity seen at each stage of development are frequently limits on the child's production (not perception or storage). In the present context, the important point is that J, at stage 4, devised a rule that enabled him to add a difficult fricative (intervocalic /s/) to his set of productions and still avoid the problem posed by pronouncing this sound in a word with an initial stop. That stage 4 represents a step backward from the adult point of view is clear; for the child, however, such a

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[17] Kiparsky and Menn 1977, however, claim that all rules, even so called 'natural' rules, must be discovered.

[18] Bower 1976 (and others) have documented somewhat related phenomena in the non-linguistic, physical development of the child: "as an infant grows, he can acquire certain skills, lose them and ultimately acquire them". Similarly, Meltzoff and Moore 1977 report on the imitation of facial and manual gestures by neonate infants, but Jacobson 1979 challenges the Meltzoff-Moore interpretation.

stage is progress.

A different type of regression is discussed in Macken 1979a which presents a re-analysis of the data found in Smith 1973. Macken notes the following correspondences:

	puddle-type words	pickle-type words
stage 23	[pʌgəl]	[pikəl]
stage 29	[pʌdəl]	[pitəl]

The interpretation given to these data is that prior to stage 29, Amahl had words like puddle mentally stored with an intervocalic /g/ and that when the child 'discovered', at stage 29, that puddle-words should have an intervocalic /d/, he changed his /g/ to /d/--a change that results in the errors seen in the pickle-type words. The data show that the child actively organizes phonologically relevant information, constructs an organizational network (and at times a unique network) for words in his mental lexicon, and formulates rules that then operate on sets of related words.

Changing hypotheses. Sometimes children replace one systematic rule with another rule that is equally systematic. Yet this new rule does not represent a step toward the adult language. We interpret such a rule change as an indication that the child has changed his/her hypothesis about an 'acceptable' way to pronounce a difficult sound or set of sounds. These 'changing hypotheses' often involve overgeneralization. Overgeneralization is itself a type of regression but one in which a production is simply further from the correct adult pronunciation at time 2 than at time 1 (n.b. 'regression' above represents a loss of a previously correct sound). Thus, when Jane overgeneralizes her /tr,dr/ → [f] rule to other stop + r clusters (see above, 'overgeneralization'), one consequence is that her previous production of [pʰ] for /pr/ "regresses" in that [f] for /pr/ is less adult-like than was [pʰ]. Note, however, that neither [pʰ] nor [f] is correct--the former is simply more like the adult [pʰr] than is the latter. Further, the regression to [f] seems to be the result of a change in Jane's hypothesis about an acceptable way to pronounce stop + r clusters: that this is a change in hypotheses is inferred from the fact that prior to this point, Jane had an equally systematic rule whereby all such clusters were produced as singleton stops. A similar example of 'changing hypotheses' comes from Smith 1973[19]:

	A	B	C
side	[ɖaIt]	[ɖaIt]	[laIt]
light	[ɖaIt]	[laIt]	[laIt]
	2;2	2;4	2;5

In stage C, Amahl has regressed in two senses: first, he has lost the contrast between side and light that he maintained in his speech at stage B, and second, the production of [l] is less close to adult /s/ than was [d] (stage B). Smith describes this change as a change in Amahl's theory about how to pronounce /s/:

What appears to be happening is that the child is confronted with

[19] Smith calls such cases examples of "recidivism".

> a number of perceptually discrete but for him unpronounceable sounds and proceeds to formulate hypotheses as to their nature in terms of the distinctive features already available to him. Having mastered the sonorant continuant [l] he presumably hypothesised that [continuant] rather than [fricative] was the crucial feature characteristic of /s/ ... as well as of /l/.... In fact, there was a very slight tendency to generalize beyond the examples given here, and extend the rule to /θ/--thank you appeared briefly as [lɛŋku:]--and to all occurrences of /s/ irrespective of environment.... (1973:153).

Itkonen 1977 gives several examples of the overgeneralization type of regression from a corpus based on the speech of a young child acquiring Finnish.

Cases of 'overgeneralization', 'regression' and 'changing hypotheses' within a single child's corpus provide the best evidence for the child's active role in the formulation of rules, but evidence can also be found in the differences between the rules of individual children. Farwell 1976 reports on four approaches for the production of fricatives ("favorite sounds", "avoidance", "syllabic fricatives" and "word position") that were used by seven children followed by the CPP. Farwell identifies these approaches as "strategies" and observes that they demonstrate the "child's active organization of his language". Of particular present relevance is the syllabic fricative strategy of MF (the only child among the seven to devise this particular rule): "For two months (10 sessions), only four adult fricative words occurred in her production, only one more than once. Then MF began to produce fricative words as mid to back fricatives and affricates without a vowel.... She used this method for sheep, shoe, juice, chip, chicken, zebra, fish and flower (101)." Farwell comments, "I thought this an idiosyncratic way of learning fricatives until last year when, in another study, I found a child, Amy, who had adopted the same strategy, using it for the words cheese, juice and shoe (101)." Another striking example of the novel rules children may invent comes from the 1976 CPP study: at 1;10.7, Tessa--for the first time--contrasted final voiced versus voiceless stops, and she did so not as adults would but by aspirating the final voiceless stops (e.g. book [poʊkʰ] and producing final voiced stops as a separate syllable, voiced stop + [ə] (e.g. pig [pʰIgə]). These two rules--syllabic fricatives and the extra syllable for voiced stops--are unusual, and for this very reason they are also good evidence of the child's 'creation' of phonological rules.

Much more could be said about individual differences in phonology acquisition; however, before leaving this topic, we should point out that there have been many attempts to find patterns in the variation between children. Leont've 1965 (quoted in Jones 1967) refers to the possiblity of classifying a certain stage in the speech behavior of children into two types: at about one year some children produce speech forms which represent a reduction of adult forms to monosyllable utterances, while others tend to produce utterances which have the same syllabic and accentual patterns of the adult forms (but apparently with imprecise phonetic qualities). Peters 1977 discusses two types of speech--analytic and gestalt--that may reflect two language learning strategies. Vihman 1976 suggests that different phonological styles may correlate with different personalities of children--cautious versus non-cautious--; similarly, Leopold 1947 attributes the absence of metathesis in Hildegard's speech to her "generally cautious speech habits" (237) and her "conscientious...attempts at reproducing standard words" (239) (cf. also

Ingram 1979). Drawing on the information processing model for interpreting individual differences of, e.g., Zelnicker and Jeffrey 1976, Macken 1976 and 1979b relate two different types of phonological behavior to the difference between global versus detail processing styles: "This analysis of differences in terms of cognitive style is not an unreasonable extension of a cognitive model of phonology, one emphasizing the problem-solving nature of acquisition, and is promising in that it may--if successful--restrict the range of individual phonological differences to several sets or syndromes typical of different styles" (Macken 1979b, 47). The point remains, however, that even children who could be said to be similar in general style or strategy still devise quite different and sometimes unique rules. It is partly because there are widespread individual differences (e.g. nearly every child we have studied produces at least one unique but systematic rule) that we suggest that the general acquisition process is one of hypotheses formation.

2.4 Discussion

In sections 2.1-2.3, we culled data from a variety of sources and interpreted those data as evidence for cognitively relevant aspects of phonology acquisition. Implicit in the order of presentation was a broad outline of what a cognitive model of acquisition might look like. In this section, we will make the model explicit to the extent possible and attempt to evaluate its strengths and weaknesses. We emphasize that such an attempt is premature: more data must be collected to verify even the phenomena we have identified and more new analyses from a cognitive perspective must be carried out to enrich and/or limit our generalizations. In short, only future work will decide whether such an outline can be replaced with an explicit and testable model.

What, then, is the picture of the acquisition process that emerges from these data? We begin with the observation that the data from a very young child--one just learning to talk--are piecemeal and apparently unintegrated. It seems that the child initially analyzes word shapes on an individual basis. It is not surprising that such a child should produce phonological idioms, since idioms are in fact simply isolated cases of accuracy. At some point, the child begins to recognize similarities between classes of sounds and sounds-in-combination, and to construct rules for relating similar sounds and word shapes and to formulate rules that solve the pronunciation difficulties the child encounters. That the process is not automatic can be shown in the variable experimentation forms that children sometimes produce as they search for a solution and in the "range and diversity of [different children's] solutions" (Kiparsky and Menn 1977). A child's experimentation can elucidate the conflicting parameters that the child is struggling with. As a result of what appears to be a basic hypothesis-forming and testing process, the child decides on a particular rule and then applies it to other, related items--i.e. to sounds or words forming the membership of the child's category. It is generally the case that the child's categories do not correspond directly to those of an adult. The child may then overgeneralize the newly discovered rule, as he/she integrates the new rule into his/her system. Often, the formation of a rule and/or its overgeneralization results in regression--or apparent loss of ability. Such cases of regression demonstrate that the process is not a simple unfolding of abilities or a linear progression toward adult competence. As the child comes to recognize new and relevant information (or alternatively, the relevant 'counterexamples' to the previous hypo-

theses, see Karmiloff-Smith and Inhelder terminology, below), the child changes hypotheses (or 'theories') and creates new rules. Many steps in this process can be seen in the development of Jane's clusters as presented in Table 1.

Stated in the above way, the process of acquiring phonology looks very similar to the development of what are more commonly called cognitive abilities and, in particular, to the process of acquiring physical (weight and balance) information as reported in Karmiloff-Smith and Inhelder 1974/75. Those authors report a study that investigated children's ability to perform a block-balancing task in which the blocks were of different sizes and shapes and had unexpected distributions of weight over their lengths. From the developmental process the authors observed, we can extrapolate the following stages: (a) single item match; (b) gradual recognition of a pattern; (c) period of exploration; (d) construction of a theory, followed by generalization ('overgeneralization' in the sense used in section 2.3) and loss of ability (i.e. loss of the success of stage a); (e) gradual recognition of regularity of counterexamples; (f) construction of a new theory, distinct from the first theory; and (g) gradual development of a single unifying theory. Clearly this 'model' is similar in important respects to the one that we have outlined for the acquisition of phonology.

To evaluate this cognitive model, we first note that it handles well precisely those kinds of data that were presented in sections 2.1-2.3 and, further, that such data are difficult to explain within a universalist model.[20] Second, as we have tried to show in each section, the phonological phenomena seem to have direct analogues in other areas of language development. Third, if the analogy with, for example, the Karmiloff-Smith and Inhelder model of cognitive development is well-founded, the cognitive-phonology model promises to interact well with a general model of child development. Thus, the model begins to account for the data, is consistent with general aspects of language development and is based on a defensible model of the general conceptual, problem-solving skills of young children.

What problems will a cognitive model of phonology acquisition encounter? We will discuss four: empirical verification; data which the model may not handle well; the absence of distinguishing features of the model as a model of phonology acquisition; and the model's generality.

First, internal to the model are the apparent relative rarity of some examples (e.g. idioms, experimentation, etc.), and the tasks of documenting further the phenomena we have identified and elaborating the model. One particular problem in this category is the fact that some children produce few forms of the types discussed in sections 2.1-2.3; these children stay fairly close to the adult models (cf., however, the discussion at the end of section 2.3). These are essentially empirical problems to be solved by future research.

Second, it could be argued that such a model will have difficulty handling universals: if we assume a thorough-going cognitive or problem-solving

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[20] There are of course other alternative models (including a hybrid variety). We here restrict the discussion to two sharply contrasted points of view to clarify the implications of the cognitive model.

process as basic, how do we explain the fact that so many children arrive at the same or similar solution? In section 2.0, we suggested that universals are due to universal characteristics of the human auditory and articulatory apparatus. To this we now add that children presumably share the same or a significantly similar conceptual apparatus. As a result, constraints are imposed on the range of possible variation and broadly similar sequences of phonological development are followed. It is important to note that those universals that do exist are less of a problem to a cognitive model than is the large number of individual differences to a universalist model. Nevertheless, for the cognitive model to represent an advance in the field, it must incorporate the results of previous research. We fully expect there to be an interplay between pre-wiring (perhaps even of the sort with specifically linguistic consequences), experience, the learner and the language. The point to be emphasized is that the hallmark of the child's development--in phonology as elsewhere--is his/her flexibility in creatively adapting to new information. The important problem is to specify how all factors interact to produce the observable developmental sequence. In phonology studies, the conceptual abilities of the child and the cognitive aspects of the task have been generally ignored.

The third problem--which perhaps is a concomitant of the model's compatibility with a general cognitive model--is the absence of any unique features: as outlined above, there appears to be no particular aspects of the model that relate to any unique features of phonology as the domain of acquisition. On the one hand, it is reasonable to hypothesize that, although there will be differences in conceptual structures across domains due to differences in content between those domains, there will be no differences in conceptual processes, such as categorization, inferencing, etc. Yet it also seems to be the case that human behavior is highly affected by context--by the structure of particular domains: specialized strategies are devised to solve certain problems and these strategies are affected by the problems themselves. Thus, we would caution researchers in phonology acquisition to not ignore those unique aspects of phonological learning--if such exist--that derive from the unique properties of phonological systems.

The fourth and most serious problem is the generality of this model. For example, this model is inexplicit on how the phonological categories are formed or what the specific form of the phonological representation is. A more insidious problem is that such a model can in theory explain anything and thus is difficult to constrain, test and disprove. For example, we drew heavily on children's errors and interpreted them as more or less 'clever' solutions. The problem here is one of over-interpretation. Clearly, criteria must be established to distinguish low-level matches (e.g., a = b) from higher level organizational or categorization strategies (e.g., a is like b); both of these result in errors from a adult point of view but only the latter, we would argue, are 'cognitive' in the sense the model intends.[21]

Since the processes and structures are all inferred and the model not formally constrained, it will be difficult to find answers to questions such

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[21] It, however, may prove to be true that low-level auditory and articulatory processes are relevant for a cognitive theory (cf. Norman 1979 on the cognitive aspects of the development of skills like typing).

as the following: what child errors or other data could count as counter evidence to the model?; what child productions or behavior could count as independent corroboration?; and--most importantly--what testable predictions does the model make? We began this section by noting that a trend toward a more cognitive model of phonology acquisition was emerging. Clearly at such an early stage, answers to questions like these cannot be given. We believe that enquiry along lines suggested in this section (and already being pursued by a few workers in the field) will prove valuable and that future research will result in a full model that is both explanatorily adequate and testable.

References

Aldis, O. Play fighting. New York: Academic Press, 1975.

Avedon, E.M. & Sutton-Smith, B. (Eds.), The study of games. New York: John Wiley & Sons, 1971.

Berman, R.A. Natural phonological processes at the one-word stage. Lingua, 1977, 43, 1-21.

Bloom, L. One word at a time: the use of single word utterances before syntax. The Hague: Mouton, 1973.

Bower, T.G.R. Repetitive processes in child development. Sci Am, 1976, 235 (5), 38-47.

Braine, M.D.S. The ontogeny of English phrase structure: the first phrase. Lg, 1963, 39, 1-13.

Braine, M.D.S. On what might constitute a learnable phonology. Lg, 1974, 50(2), 270-299.

Branigan, G. Syllable structure and the acquisition of consonants: the great conspiracy in word formation. J of Psycholinguistic Research, 1976, 5, 117-137.

Brown, R. A first language: the early stages. Cambridge, MA: Harvard University Press, 1973.

Brown, R. & Hanlon, C. Derivational complexity and order of acquisition. In J.R. Hays (Ed.), Cognition and the development of language, New York: John Wiley & Sons, 1970.

Bruner, J.S. The ontogenesis of speech acts. J Ch Lang, 1975, 2, 1-19.

Bruner, J.S. & Sherwood, V. Peekaboo and the learning of rule structures. In J.S. Bruner et al. (Eds.) Play. Harmondsworth, England: Penguin Books, 1976, 277-285.

Bruner, J.S., Jolly, A. & Sylva, K. (Eds.). Play: its role in development and evolution. Harmondsworth, England: Penguin Books, 1976.

Cazden, C. The acquisition of noun and verb inflections. Ch Dev, 1968, 39, 433-438.

Cazden, C. Play and metalinguistic awareness: one dimension of language experience. Urban Review, 1974, 7, 23-39.

Chao, Y.R. The Cantian idiolect: an analysis of the Chinese spoken by a twenty-eight-month-old child. In C.A. Ferguson & D.I. Slobin (Eds.), Studies of child language development. New York: Holt, Rinehart and Winston, 1973, 13-33.

Claparède, E. Psychologie de l'enfant et pedagogie experimentale. Nauchâtel: Delachaux & Niest &, 1906.

Clumeck, H.V. Studies in the acquisition of Mandarin phonology. Unpublished Ph.D. dissertation. Berkeley: University of California, 1977.

Clumeck, H.V. The acquisition of tone. In C. Yeni-Komshian, J. Kavanaugh and C.A. Ferguson (Eds.), Child phonology: perception and production. New York: Academic Press, 1980.

Conklin, N. Linguistic play in its cultural context. Lg, 1959, 35, 631-636.

Cruttenden, A. A phonetic study of babbling. British Journal of Disorders of Communication, 1970, 5, 110-118.

Crystal, D. Non-segmental phonology in language acquisition. Lingua, 1973, 32, 1-45.

Crystal, D. The analysis of intonation in young children. In F.D. Minifie & L.L. Lloyd (Eds.), Communicative and cognitive abilities - early behavioral assessment. Baltimore: University Park Press, 1978, 257-271.

Day, R.S. On learning "secret languages". Haskins Laboratories Status Report on Speech Research, 1973, SR-34, 141-150.

Dodd, B. The acquisition of phonological skills in normal, severely sub-normal and deaf children. Ph.D. dissertation. London: University of London, 1974.

BEST COPY AVAILABLE

Donaldson, M. Children's minds. New York: W.W. Norton & Co., 1978.

Donegan, P.J. & Stampe, D. The study of natural phonology. In D.A. Dinnsen (Ed.), Current approaches to phonological theory. Bloomington: Indiana University Press, 1979, 126-173.

Drachman, G. Some strategies in the acquisition of phonology. In R.J. Kenatowica & C.W. Kisseberth (Eds.), Issues in phonological theory. The Hague: Mouton, 1973, 145-159.

Edwards, M.L. One child's acquisition of English liquids. Papers and Reports on Child Language Development, 1971, 3, 101-109.

Edwards, M.L. Word-position in fricative acquisition. Paper presented at Boston University Conference on Language Development, 1978a.

Edwards, M.L. Patterns and processes in fricative acquisition: longitudinal evidence from six English-learning children. Ph.D. dissertation. Stanford: Stanford University, 1978b.

Edwards, M.L. Phonological processes in fricative acquisition. Paper presented at Stanford Child Language Research Forum, 1979.

Engel, W.v.R. Un esempio di "linguistic consciousness" nel bambino piccolo. Translated in C.A. Ferguson & D.I. Slobin (Eds.), Studies of child language development. New York: Holt, Rinehart and Winston, 1973, 155-158.

Fagen, R. Modelling how and why play works. In J.S. Bruner et al (Eds.), Play. Harmondsworth, England: Penguin Books, 1976.

Farwell, C.B. Some strategies in the early production of fricatives. Papers and Reports on Child Language Development, 1976, 12, 97-104.

Ferguson, C.A. Learning to pronounce: the earliest stages of phonological development in the child. In F.D. Minifie & L.L. Lloyd (Eds.), Communicative and cognitive abilities - early behavioral assessment. Baltimore: University Park Press, 1978, 273-297.

Ferguson, C.A. Phonological development: some cognitive aspects. Lecture given in the series Current Issues in Cognitive Science, Brown University, Provilence, Rhode Island, 1979.

Ferguson, C.A. & Farwell, C.B. Words and sounds in early language acquisition. Lg, 1975, 51, 419-439.

Ferguson, C.A. & Garnica, O.K. Theories of phonological development. In E.H. Lenneberg & E. Lenneberg (Eds.), Foundations of language development, Vol. II. New York: Academic Press, 1975, 153-180.

Ferguson, C.A., Peizer, D.B. & Weeks, T.E. Model-and-replica phonological grammar of a child's first words. Lingua, 1973, 31, 35-65.

Fey, M. & Gandour, J. Problem-solving in phonology acquisition. Paper presented at the 54th Annual meeting of the Linguisitc Society of America, Los Angeles, California, 1979.

Fodor, J.A. How to learn to talk: some simple ways. In F. Smith & G.A. Miller (Eds.), The genesis of language. Cambridge, MA: MIT Press, 1966.

Freud, S. Der Dichter und das Phantasieren. Neue Revue, 1908, 1, 716-724.

Fry, D.B. The development of the phonological system in the normal and the deaf child. In F. Smith & G.A. Miller (Eds.), The genesis of language. Cambridge, MA: MIT Press, 1966.

Garvey, C. Play with language and speech. In S. Ervin-Tripp & C. Mitchell-Kernan (Eds.), Child discourse. New York: Academic Press, 1977a, 27-47.

Garvey, C. Play. Cambridge, MA: Harvard University Press, 1977b.

Gelman, R. Human development. Paper presented at the La Jolla Conference on Cognitive Science, University of California, San Diego, La Jolla, California, 1979.

Gilbert, J. On the vowel and its nature, between eighteen months and five years. Proceedings of the Ninth International Congress of Phonetic Sciences, Vol. II, 1979, 134-141.

Goldin-Meadow, S. & Feiman, H. The development of language-like communication without a language model. Science, 1977, 197, 401-403.

Greenberg, J.H. & Jenkins, J.J. Studies in the psychological correlates of the sound system of American English I, II. Word, 1964, 20, 157-177.

Greenlee, M. Some observations on initial English consonant clusters in a child two to three years old. Papers and Reports on Child Language Development, 1973, 6, 97-106.

Haas, M.R. Burmese disguised speech. Bulletin of the Institute of History and Philology (Academia Sinica 39, part 2), 1969, 277-285.

Halle, M. Phonology in generative grammar. Word, 1962, 18, 54-72.

Halliday, M.A.K. Learning how to mean. London: Edward Arnold, 1975.

Herron, R. & Sutton-Smith, B. (Eds.), Child's play. New York: John Wiley & Sons, 1971.

BEST COPY AVAILABLE

Hooper, J.B. Substantive evidence for linearity: vowel length and nasality in English. In W.A. Beach, S.E. Fox & S. Philosoph (Eds.), Papers from the 13th regional meeting CLS. Chicago: CLS, 1977.

Huizinga, J. Homo ludens; proeve eener bepaling van het spil-element der cultuur. Haarlem: Tjeenk Willink, 1938.

Huizinga, J. Homo ludens, a study of the play element in culture. London: Routledge & Kegan, 1949.

Hutt, C. Exploration and play in children. Symposium of the Zoological Society of London, 1966, 18, 61-81.

Ingram, D. Phonological rules in young children. J Ch Lang, 1974, 1(1), 49-64.

Ingram, D. Cross linguistic evidence on the extent and limit of individual variation in phonological development. Paper presented at the International Congress of Phonetic Sciences, Copenhagen, 1979.

Ithonen, T. Notes on the acquisition of phonology. English summary of Huomiota lapsen äänteistön kehityksestä. Virittäjä, 1977, 279-308. [English summary 304-308.]

Jacobson, S.W. Matching behavior in the young infant. Ch Dev, 1979, 50, 425-430.

Jakobson, R. Kindersprache, Aphasie und allgemeine Lautgesetze. 1941. [Translated by A.R. Keiler. Child language, aphasia and phonological universals. The Hague: Mouton. 1968.]

Jeng, H-H. The acquisition of Chinese phonology in relation to Jakobson's laws of irreversible solidarity. Proceedings of the Ninth International Congress of Phonetic Sciences, Vol. II, 1979, 155-161.

Jespersen, O. Language: its nature, development and origin. New York: H.Holt & Co., 1929.

Jones, L.G. English phonotactic structure and first language acquisition. Lingua, 1967, 19, 1-59.

Karmiloff-Smith, A. & Inhelder, B. If you want to get ahead, get a theory. Cognition, 1974/75, 3(3), 195-212.

Keenan, E.O. Conversational competence in children. J Ch Lang, 1974, 1, 163-183.

Kiparsky, P. & Menn, L. On the acquisition of phonology. In J. Macnamara (Ed.), Language learning and thought. New York: Academic Press, 1977, 47-78.

Kirshenblatt-Gimblett, B. (Ed.), Speech play: research and resources for studying linguistic creativity. Philadelphia: University of Pennsylvania Press, 1976.

Kisseberth, C.W. On the functional unity of phonological rules. Ling Inquiry, 1970, 1, 291-306

Kunmann, P.W. Reduplication as a strategy for language acquisition. Paper presented at the summer LSA Meeting, Oswego, New York, 1976.

Labov, W. & Labov, T. The phonetics of cat and mama. Lg, 1978, 54(4), 816-852.

Leonard, L.B. & Newhoff, M. The nature of early child phonology: evidence from the speech of twins. Unpublished manuscript. 1978.

Leopold, W.F. Speech development of a bilingual child: a linguist's record. Vol. II. Sound learning in the first two years. Chicago: Northwestern University Press, 1947.

Li, C.N. & Thompson, S.A. The acquisition of tone in Mandarin-speaking children. J Ch Lang, 1977, 4, 185-199.

Lieberman, P. On the development of vowel production in young children. In G.H. Yeni-Komshian, J.F. Kavanaugh & C.A. Ferguson (Eds.), Child phonology: perception and production. New York: Academic Press, 1980.

Macken, M.A. Individual differences in phonological acquisition: strategies versus cognitive styles. Paper presented at the Child Language Seminar Series, Stanford University, Stanford, California, 1976.

Macken, M.A. The acquisition of stop systems: a cross-linguistic perspective. Paper presented at NICHD Conference on Child Phonology, Bethesda, MD., 1978. In G.H. Yeni-Komshian, J.F. Kavanaugh, & C.A. Ferguson (Eds.), Child phonology: perception and production. New York: Academic Press, 1978.

Macken, M.A. Permitted complexity in phonological development: one child's acquisition of Spanish consonants. Lingua, 1978, 44, 219-253.

Macken, M.A. The child's lexical representation: the 'puzzle-puddle-pickle' evidence. Papers and Reports on Child Language Development, 1979, 16, 26-41. (To appear J Ling, 1980.)

Macken, M.A. Developmental reorganization of phonology: a hierarchy of basic units of acquisition. Lingua, 1979, 49, 11-49.

Macnamara, J. Cognitive basis of language learning in infants. Psych Review, 1972, 79, 1-13.

BEST COPY AVAILABLE

McNeil, D. The acquisition of language and the study of developmental psycholinguistics. New York: Harper & Row, 1970.

Meltzoff, A.N. & Moore, M.K. Imitation of facial and manual gestures by human neonates. Science, 1977, 198, 75-78.

Menn, L. Phonotactic rules in beginning speech. Lingua, 1971, 26, 225-251.

Menn, L. A theoretical framework for child phonology. Paper presented at summer LSA Meeting, Amherst, MA, 1974.

Menn, L. Evidence for an interactionist-discovery theory of child phonology. Papers and Reports on Child Language Development, 1976, 12, 169-177.

Menyuk, P. & Bernholtz, N. Prosodic features and children's language production. MIT RLE QPR, 1969, 93.

Messer, S. Implicit phonology in children, JVLVB, 1967, 6, 609-613.

Mikeš, M. Universal and language-restricted rules in the development of the phonological systems in child language. Paper presented at the International Symposium on Child Language, Mexico City, 1976.

Millar, S. The psychology of play. Hammondsworth, England: Penguin Books.

Moskowitz, B.A. The two-year-old stage in the acquisition of English phonology. Lg, 1970, 46, 426-441.

Moskowitz, B.A. Acquisition of phonology and syntax. In K.J.J. Hintakka, J.M.E. Moravcsik & P. Suppes (Eds.), Approaches to natural language. Dordrecht, Holland: Reidel Publishing Co., 1973, 48-84.

Moskowitz, B.A. The acquisition of language. Sci Am, 1978, 239(5), 92-108.

Mowrer, O.H. Speech development in the young child: the autism theory of speech development and some clinical applications. J Sp & Hrng Disorders, 1952, 17, 263-268.

Murai, J. The sounds of infants, their phonemicization and symbolization. Studia Phonologica, 1963, 3, 18-34.

Norman, D.A. Twelve issues for cognitive science. Paper presented at the La Jolla Conference on Cognitive Science, University of California, San Diego, La Jolla, California, 1979.

Oller, D.K., Wieman, L.A., Doyle, W.J. & Ross, C. Infant babbling and speech. J Ch Lang, 1976, 3, 1-11.

Oller, D.K. The emergence of the sounds of speech in infancy. In G.H. Yeni-Komshian, J.F. Kavanaugh & C.A. Ferguson (Eds.), Child phonology: perception and production. New York: Academic Press, 1980.

Olmsted, D.L. A theory of the child's learning of phonology. Lg, 1966. 42(2), 531-535.

Olmsted, D.L. Out of the mouths of babes. The Hague: Mouton, 1971.

Peters, A.M. The beginnings of speech. Papers and Reports on Child Language Development, 1974, 8, 26-32.

Peters, A.M. Language learning strategies. Lg, 1977, 53(3), 560-573.

Piaget, J. La formation du symbole chez l'enfant. Neuchâtel: Delachaux & Niestlé, 1945.

Piaget, J. Play, dreams and imitation in childhood. London: Routledge & Kegan Paul, 1951.

Pierce, J. A study of 750 Portland, Oregon children during the first year. Papers and Reports on Child Language Development, 1974, 8, 19-25.

Price, R. & Price, S. Secret play languages in Saramaka: linguistic disguise in a Caribbean creole. In B. Kirshenblatt-Gimblett (Ed.), Speech play. Philadelphia: University of Pennsylvania Press, 1976, 37-50.

Priestley, T.M.S. One idiosyncratic strategy in the acquisition of phonology, J Ch Lang, 1977, 4(1), 45-66.

Read, C. Children's awareness of language with emphasis on sound systems. In A. Sinclair, R.J. Jarvella & W.J.M. Levelt (Eds.), The child's conception of language. Berlin: Springer Verlag, 1978, 65-82.

Ross, J.R. Constraints on variables in syntax. Ph.D. dissertation. Cambridge, MA: MIT, 1967.

Sanches, M. & Kirshenblatt-Gimblett, B. Child language and children's traditional speech play. In B. Kirshenblatt-Gimblett(Ed.), Speech play. Philadelphia: University of Pennsylvania Press, 1976.

Sapir, E. Sound pattern in language. Lg, 1925, 1, 37-51.

Scollon, R. Conversations with a one year old: a case study of the developmental foundations of syntax. Honolulu: University of Hawaii Press, 1976.

Sherzer, J. Play languages: implications for (socio)linguistics. In B. Kirshenblatt-Gimblett (Ed.), Speech play. Philadelphia: University of Pennsylvania Press, 1976, 11-36.

Slobin, D.I. Comments on 'Developmental Psycholinguistics'. In F. Smith & G. Miller (Eds.), The genesis of language. Cambridge,MA: MIT Press, 1966.

Smith, N.V. The acquisition of phonology. Cambridge: University Press, 1973.

Smith, N.V. The acquisition of phonological skills in children. British Journal of Disorders of Communication, 1974, 9, 17-23.

Smith, N.V. Universal tendencies in the child's acquisition of phonology. In N. O'Connor (Ed.), Language, cognitive deficits and retardation. London: Butterworths, 1975, 47-65.

Smith, N.V. Lexical representation and the acquisition of phonology. Forum lecture at the LSA Institute, Urbana, Illinois, 1978.

Srivastava, G.P. A child's acquisition of Hindi consonants. Indiana Linguistics, 1974, 35, 112-118.

Stampe, D. The acquisition of phonetic representation. Paper presented at the 5th Regional Meeting of the CLS, Chicago, Illinois, 1969, 443-454.

Stampe, D. A dissertation on natural phonology. Ph.D. dissertation. Chicago: University of Chicago, 1973.

Stanley, R. Redundancy rules in phonology. Lg, 1967, 43, 393-435.

Stark, R.E. Features of infant sounds: the emergence of cooing. J Ch Lang, 1978, 5, 379-390.

Stark, R.E. Stages of speech development in the first year of life. In G.H. Yeni-Komshian, J.F. Kavanaugh & C.A. Ferguson (Eds.), Child phonology: perception and production. New York: Academic Press, 1980.

Stark, R.E., Rose, S.N. & McLagen, M. Features of infant sounds: the first eight weeks of life. J Ch Lang, 1975, 2, 205-211.

Sutton-Smith, B. Play and learning. New York: Halsted Press, 1979.

Sylva, K., Bruner, J.S. & Genova, P. The role of play in the problem-solving of children 3-5 years old. In J.S. Bruner et al (Eds.), Play. Hammondsworth, England: Penguin Books, 1976, 244-257.

Tims, L. A child's acquisition of Russian phonology. J Ch Lang, 1977, 4, 329-339.

Tse, J.K-P. Tone acquisition in Cantonese: a longitudinal case study. J Ch Lang, 1978, 5, 191-204.

Vanvik, A. The phonetic-phonemic development of a Norwegian child. In H. Vogt (Ed.), Norsk tidsskrift for sprogvidenskap. Bind XXIV, Universitetsforlaget, 1971, 269-325.

Vennemann, T. Language acquisition and phonological theory. Ling, 1971, 70, 71-87.

Vihman, M.M. On the acquisition of Estonian. Papers and Reports on Child Language Development, 1971, 3, 51-94.

Vihman, M.M. From pre-speech to speech: on early phonology. Paper presented at the 8th Child Language Research Forum, Stanford University, Stanford, California, 1976.

Vihman, M.M. Consonant harmony: its scope and function in child language. In J.P. Greenberg, C.A. Ferguson & E.A. Moravcsik (Eds.), Universals of human language, Vol. 2. Stanford: Stanford University Press, 1978, 281-334.

Ultan, R. A typological view of metathesis. Working Papers in Language Universals, 1971, 7, 1-44.

Waterson, N. Some speech forms of an English child--a phonological study. Trans Philol Soc, 1970, 1-24.

Waterson, N. Child phonology: a prosodic view. J Ling, 1971, 7, 179-211.

Weeks, T. The slow speech development of a bright child. Lexington, MA: D.C. Heath, 1974.

Weir, R. Language in the crib. The Hague: Mouton, 1962.

Winitz, H. Articulatory acquisition and behavior. New York: Appleton-Century-Croft, 1969.

Zelniker, T. & Wendell, J. Reflective and impulsive children: strategies of information processing underlying differences in problem solving. SRCD Monographs, 1976, 41(5).

Zlatin-Laufer, M. & Horii, Y. Fundamental frequency characteristics of infant non-distress vocalization during the first twenty-four weeks. J Ch Lang, 1975, 4, 171-184.